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BRONZED WOODPECKER

(Piculus aeruginosus)

Adult male, sketched February 10, 1938, on the Mesa de Chipinque, near Monterrey, Nuevo Leon, by George Miksch Sutton. Sixth in a series of color-plates honoring the memory of Dr. David Clark Hilton.

BRONZED WOODPECKER

BY GEORGE MIKSCH SUTTON

THE Bronzed Woodpecker (*Piculus aeruginosus*) is an uncrested Mexican woodpecker about ten inches long. It is known also as the Lichtenstein's Woodpecker and Bronze-winged Woodpecker. In conversation I have recently heard it referred to as the Green Woodpecker or Mexican Green Woodpecker —apt enough names, to be sure, but unacceptable since the much larger, wholly different *Picus viridis* of the Old World has long been known as the Green Woodpecker.

The Bronzed Woodpecker's callnotes and behavior instantly remind the newcomer to México of a flicker (*Colaptes*). It is not white-rumped; it has no predilection for ants, so far as I know; and I have never seen it feeding on, or flying up from, the ground; but it has a flickerlike way of sitting quietly on a horizontal dead branch in the very top of a tree, tail not propping it against its perch, but hanging straight down. It also has a flickerlike courtship display. Three or four birds gather, spread their wings and tails, and bob and bow at each other while calling excitedly, interrupting their 'dance' with brief periods of statuesque motionlessness. A display of this sort I observed on April 18, 1941, along the Río Sabinas, in the Gómez Farías region of southwestern Tamaulipas (Sutton and Pettingill, 1942, *Auk*, 59:19).

When one sees the Bronzed Woodpecker for the first time one is apt to notice the bird's greenness. Actually, the crown is slate gray; the face white, passing from pale buff on the lores to grayish white on the auriculars; the throat grayish white streaked with dusky; the rest of the under parts olive, irregularly barred with yellowish white—but what one first sees, as the bird bounds along in flight, or hitches up a tree, is the mossy green of its upper parts. The wings have a golden brown, or bronzy, cast. In both the male and female the whole of the nape and hind neck are bright red. The moustaches of the male are red, of the female ashy gray, streaked with dusky. Young birds are strikingly similar to adults, sex for sex. A nestling male (wing and tail feathers much sheathed at base) in my collection is as brightly red on the hind neck and moustaches as the brightest adult male in my series. The specimen was taken May 27, 1949, at the Rancho del Cielo (elevation 3300 feet), near Gómez Farías, Tamaulipas, by Paul S. Martin. The nest, which held "at least three young" on that date, was near the top of a stubby dead 40-foot sweet gum (*Liquidambar styraciflua*). Ridgway (1914. *U. S. Natl. Mus. Bull.* 50, Part 6, p. 130) states that in the young male the red of the nape extends "forward, along sides of crown and forehead, to base of bill." In the specimen to which I have just referred the red extends no farther for-

ward than the eyes. Dr. Herbert Friedmann informs me that the immature specimens Ridgway described may have been examples of *Piculus rubiginosus yucatanensis*. Two such specimens (from Chiapas and Tuxla, Veracruz) have been in the U. S. National Museum collection "from early enough to have been available to Ridgway and are probably the basis for his statement."

The Bronzed Woodpecker ranges from central Nuevo León and southern Tamaulipas southward through San Luis Potosí to Puebla and northern Veracruz. At the northern frontier of its range it is found only in the mountains. E. A. Goldman, in "Biological Investigations in México" (1951. *Smithsonian Misc. Coll.*, Vol. 115), calls it a species of the Humid Lower Tropical Subzone (p. 326) as well as of the Arid Upper Tropical Subzone (p. 330). It is non-migratory, but birds which summer high in the mountains may seek lower elevations in winter. In the Gómez Farías region of Tamaulipas, in the spring of 1941, the Cornell University-Carleton College Expedition found it "on the mountain as well as at river-level." That year, on March 27, in heavy forest about a thousand feet above the Sabinas, Dwain W. Warner collected a male with not very distinct brood-patch at a recently finished nest near the top of a 30-foot dead stub. On April 24, at river-level, Olin S. Pettingill, Jr. discovered a nest which probably held eggs or small young on that date (Sutton and Pettingill, *loc. cit.*). C. Richard Robins and William B. Heed (1951. *Wilson Bull.*, 63:266) inform us that at La Joya de Salas, Tamaulipas, at an elevation of 5500 feet, they observed a young bird "not long out of the nest but by itself" on May 25. On the Mesa de Chipinque (5300 feet), in the mountains just southwest of the city of Monterrey, Nuevo León, the species is fairly common, but I have never seen it thereabouts at city-level (1700 feet) even in winter. On May 7, 1941, I found two nests on the Mesa de Chipinque, each in the main trunk of a large oak about 12 feet above strongly sloping ground. A male specimen which I collected that day had greatly enlarged testes and well defined brood-patch. I found the nests by following the adults about, and I believe they were feeding young, but so far as I could tell they were not carrying food in their bills. Possibly they regurgitate food at the nest, again in the manner of a flicker.

Immediately to the southward of the range of *P. aeruginosus* lives another 'green' woodpecker, *P. rubiginosus*, which is very similar to the Bronzed. This form, called by E. R. Blake (1953. "Birds of Mexico," p. 290) the Golden-olive Woodpecker, ranges eastward to Yucatán and southward well into South America. So far as I have been able to ascertain, its range does not overlap that of *aeruginosus* in Veracruz or Puebla. A third and also very similar species, the Gray-crowned Woodpecker (*P. auricularis*), is confined to western México (Guerrero to southeastern Sonora). These three

woodpeckers may possibly be conspecific. They are much alike morphologically and what I have heard and read indicates that they are similar in behavior (see Sutton, 1951. "Mexican Birds," pp. 220-221). Blake (*loc. cit.*) states that *rubiginosus* is "more decidedly a bird of the lowlands" than *aeruginosus*, but Wetmore (1943. *Proc. U. S. Natl. Mus.*, 93:273) informs us that Carriker found *P. rubiginosus yucatanensis* "fairly abundant in the forest over the higher elevations of the Sierra de Tuxtla" in southern Veracruz, and the fact that Carriker obtained specimens on the Cerro de Tuxtla (elevation of peak proper about 4000 feet) and Volcán San Martín (elevation of peak proper about 5500 feet) but not, apparently, on lower slopes, forces us to question whether *rubiginosus* inhabits the lowlands of the Sierra de Tuxtla at all.

DEPARTMENT OF ZOOLOGY, UNIVERSITY OF OKLAHOMA, NORMAN, OKLAHOMA, MAY 22, 1953

NEW LIFE MEMBER

Karl William Haller was born October 12, 1916, at Wheeling, West Virginia. In 1939, he received the degree of Bachelor of Science in Biology from Bethany College, West Virginia. Two years later he was granted the degree of Master of Science in Zoology from West Virginia University. In 1937 he was a member of the Carnegie Museum—Cornell University expedition to Oklahoma, and in 1941 was a member of the Carnegie Museum expedition to Hudson Bay. After returning from more than four years service with the Air Force in World War II, he became an instructor in Biology and Zoology at Washington and Jefferson College, Pennsylvania. He subsequently returned to active duty with the Air Force. His active interest in birds extends over a period of 20 years. He is a member of the A.O.U., British Ornithologists' Union, and Cooper Ornithological Club.

THE WHITE-THROATED MAGPIE-JAY

BY ALEXANDER F. SKUTCH

More than 15 years have passed since I was last in the haunts of the White-throated Magpie-Jay (*Calocitta formosa*). During the years when I travelled more widely through Central America I saw much of this bird, and learned enough of its habits to convince me that it would well repay a thorough study. Since it now appears unlikely that I shall make this study myself, I wish to put on record such information as I gleaned, in the hope that these fragmentary notes will stimulate some other bird-watcher to give this jay the attention it deserves.

A big, long-tailed bird about 20 inches in length, with blue and white plumage and a high, loosely waving crest of recurved black feathers, the White-throated Magpie-Jay is a handsome species unlikely to be confused with any other member of the family. Its upper parts, including the wings and most of the tail, are blue or blue-gray with a tinge of lavender. The sides of the head and all the under plumage are white, and the outer feathers of the strongly graduated tail are white on the terminal half. A narrow black collar crosses the breast and extends half-way up each side of the neck, between the white and the blue. The stout bill and the legs and feet are black. The sexes are alike in appearance.

The species extends from the Mexican states of Colima and Puebla to northwestern Costa Rica. A bird of the drier regions, it is found chiefly along the Pacific coast from México southward as far as the Gulf of Nicoya in Costa Rica. On the Caribbean side of Central America it occurs only in the more arid country back from the coast, as in the semi-desert portion of the valley of the Río Motagua in Guatemala. It is absent from the humid districts of the Caribbean littoral, where the White-tipped Brown Jay (*Psilorhinus mexicanus*) is at home.

These two big jays occupy complementary parts of the Central American lowlands, and are found together only in narrow zones of transition between the wet and dry regions. Thus in clearings amid the heavy rain-forests of the lower Motagua Valley, from the sea coast as far inland as Quiriguá, only the Brown Jay resides. Above Quiriguá the vegetation gradually becomes lighter, and between this point and Gualán the two species mingle. From Gualán to Progreso the vegetation of the valley consists largely of thorny scrub and cacti, with somewhat heavier woods in the river bottoms; and here the Magpie-Jay is abundant but the Brown Jay is absent. Likewise at Matías Romero, in the center of the Isthmus of Tehuantepec, the Brown Jay from the rainy Caribbean side intermingles with the Magpie-Jay from the dry Pacific side, the former living chiefly amid the heavier vegetation

on the lower lands; but farther toward the west, at San Gerónimo, I found only the Magpie-Jay on the hot, arid plains overgrown with cacti and thorn-scrub. So, too, on the Pacific slopes of the Cordillera of Guanacaste in Costa Rica, the Brown Jay, pushing over from the Caribbean side through the low passes, dwells alongside the Magpie-Jay; but at points in Guanacaste farther west and with a more arid type of vegetation, I met only the latter. In the western part of the Pacific slope of Guatemala the Magpie-Jay extends upward to at least 3700 feet above sea-level, and here it resides in a region where more abundant rainfall has produced forests as heavy as those of the Caribbean slope. In this district I found the larger, brighter blue Nelson's White-throated Magpie-Jay (*C. f. azurea*) common among the shade trees of the great coffee plantations.

Wherever it dwells, a bird so big, handsome, active, and noisy as the Magpie-Jay is sure to attract attention and make its presence known. In the hot, dry portion of the Motagua Valley, where much of the low vegetation bristles with forbidding thorns, and impenetrable fences of close-set cacti bar the way of the bird-watcher who would pursue his hobby off the beaten path, this is one of the first birds to stir the enthusiasm of the new arrival. Nor can one wander far beneath the tall shade trees of the beautiful coffee plantations of western Guatemala without becoming aware of this remarkable bird. For the keen-eyed jay is quick to detect the man who intrudes into his haunts, and shouts his disapproval in harsh language which all can understand. In small, straggling flocks he follows the trespasser, assailing him with a volley of abuse, and warning all other birds that a possible enemy is at hand. Because he is so excitable and ill at ease in the presence of man, I have learned little of the Magpie-Jay's diet, but presumably it is as varied as that of most members of the family. On the Isthmus of Tehuantepec I surprised a Magpie-Jay in a tree beside a field of maize. As it flew out it dropped a heavy object which proved to be a small ear of corn about three inches long, still enclosed in the husks. In Guatemala I saw a jay with berries in its bill.

The Magpie-Jay has a vocabulary far more varied than that of the Brown Jay. When scolding its notes are painfully loud and harsh. After enduring this hard language for a while, one does not expect to hear the big bird give voice to a variety of mellow, liquid calls, one of which sounds like *weep weep weep*. It also utters a medley of low, queer notes while resting inconspicuously amid the foliage. Sitting on the nest or resting near it, the breeding female repeats incessantly a loud cry of hunger, audible for a quarter of a mile, and so like the *pee-ah* of the Brown Jay that at first I mistook it for the note of the latter, and discovered my error only after I had followed to its distant source and found a blue rather than a brown jay

on the bulky pile of sticks. As they flee their nest, Magpie-Jays utter a soft and somewhat plaintive cry.

Nesting

The Magpie-Jay's nesting-season is long. At Nicoya, Costa Rica, I saw two birds carrying nest-material at the end of November, 1937. Near Colomba, Guatemala, at an altitude of about 3000 feet, I found four nests between December 20, 1934, and the following January 2; and in at least two of these incubation was going on. In El Salvador, Dickey and van Rossem (1938:415) discovered a nest with young on April 16, 1912. On the Caribbean side of the continent, at El Rancho in the Motagua Valley, the Magpie-Jays were still nesting in June and July, 1932. The first bird nest that I discovered upon my arrival at El Rancho on June 23 was one of this jay; earlier that same year the first nest that I found in the wet lower valley had been one of the Brown Jay. Incubation was apparently in progress in this inaccessible Magpie-Jay's nest. On June 26 I found another nest in which the Magpie-Jay had not yet completed her set of eggs. That the jays about El Rancho had already been breeding for a number of months was attested by the fact that at the same time full-grown young were flying about with their parents and being fed by them. Much the same situation was found at Matías Romero on the Isthmus of Tehuantepec on July 11, 1934. Young birds on the wing were being fed, but one Magpie-Jay was sitting, apparently incubating, in a nest about 50 feet up in the top of a tree beside a stream.

The two nests at El Rancho were in trees standing in pastures. The lowest, only 20 feet up, was in a *Pereskia* bristling with sharp spines; the other was 30 feet high and far out on a slender branch which held it beyond reach of a human climber. Of the nests at Colomba, one was in the top of a clump of tall bamboos growing beside a stream in a narrow valley; the other three were in shade trees of the coffee plantations, at heights estimated to be 40, 75, and nearly 100 feet. The nest of the Magpie-Jay resembles that of the Brown Jay but is often less bulky. The framework is a pile of coarse sticks, within which is a neatly finished cup of wiry roots and fibrous material, measuring about five inches in diameter.

The only nest that I could reach was the lower of those at El Rancho (belonging to the race *C. j. pompata*), and this when revisited on July 4 contained four eggs, so sharply pointed as to be almost top-shaped, in color gray, finely, densely and evenly flecked with brown. They measured 35.7 by 23.8, 35.7 by 23.8, 34.1 by 23.0, and 34.1 by 24.2 millimeters. The nest reported from El Salvador by Dickey and van Rossem contained three nestlings.

Incubation appears to be performed by the female only. On December 25 and 26, 1934, I devoted nearly 14 hours to watching the highest of all the nests I found. The lofty, white-barked trunk of the tree which bore it rose clean, straight, and branchless for about 80 feet and gave no encouragement to a climber, but the nest was in an exposed position and could be observed from a neighboring hillside. Although I could not examine the contents, it was evident that it held eggs. Of the four full-grown jays which frequented the vicinity and scolded when I came near, the one which I felt sure was the female could be distinguished by the loosely spreading feathers of her crest; the crest-feathers of the other three formed a more compact cluster. The loose-crested jay alone warmed the eggs. When hungry—as she seemed to be much of the time—she uttered loud cries which, although harsh in tone, were yet somewhat pleading. In response to these cries, the other jays brought food to her. Because of the great height of the nest and the limited time at my disposal, I was not able to determine just how many served her; there were certainly two and probably three; that is, she was fed by her mate and one or two helpers. One of the attendants had blackish feathers around the eyes (a sign of immaturity?), while the face of another was pure white.

During the course of 13 hours and 41 minutes the female jay was fed 47 times. The food was delivered to her while she sat in the nest or, rarely, while she rested near it. Often when she saw an attendant approach she would spread her wings over the sides of the nest and flutter them, at the same time crying loudly and hoarsely. Sometimes if she espied another jay coming with food while she rested near the nest she flapped her wings and cried, then hurried back to the nest to receive the morsel there. Once while the female was preening her feathers among some bushes below the nest, an attendant flew up with a bill full of berries. For about ten minutes he waited in the vicinity, then advanced to a branch about a yard distant from the nest. At last the female took notice of him and with a little whine flew directly to the nest, settled upon the eggs and received the berries. Once two jays came to the nest with food at the same time; a minute later the female was fed again, most probably by a third attendant. Once she was given food five times in four minutes.

So much food was brought to the incubating female that she did not find it necessary to hunt for herself and could devote nearly all of her time to incubation. During 13¾ hours, divided between two mornings and an afternoon, I timed 10 completed sessions on the eggs, ranging from 25 to 88 minutes and averaging 54.6 minutes. Thirteen recesses ranged from 1 to 21 minutes and averaged 8.6 minutes. She covered the eggs for 86.4 per cent of the time. Her absences generally began just after she was fed. During

her short recesses she occupied herself chiefly with preening her feathers and stretching her limbs on some convenient perch within sight of the nest, usually in the nest-tree itself. Sometimes she continued to cry for food while preening or resting near the nest. Only rarely did she fly out of sight, and then only for a part of her brief absence from the eggs; sometimes these excursions lasted only a minute or two.

The female Magpie-Jay was so jealous of her nest that she seemed to resent the approach of any of her helpers to it during her absence, and if she saw one go near it would hurry back to sit in it. This was not merely for the purpose of receiving food on the nest. Once the jay that I took to be the male fed her on the nest, then flew to a neighboring tree. The female then left the nest, and upon noticing her departure the other returned to the nest-tree and approached the nest. When she saw him going toward the nest, the female jay hurried back and settled on her eggs before he could reach them, whereupon he departed. Although the attendants freely approached the nest-tree and even the nest itself so long as the female sat in it, other Magpie-Jays which apparently did not belong to this group were repelled. Once the female left her nest to join the bird that I believed to be her mate in driving away a jay which had come into the next tree. She also jumped from the nest to drive off a Black Vulture which had come to rest on the supporting branch about fifteen feet away. The carrion-feeder took wing with a surprised grunt, then the jay returned to her eggs.

Although this Magpie-Jay received food far more frequently than any of the Brown Jays that I watched, she spent somewhat less time on the eggs. This nest differed from Brown Jays' nests in that the male did not stand guard over it during the female's recesses. But because she spent them almost wholly within sight of the nest, she could keep watch over her eggs without his assistance. Indeed, she probably would have objected to his standing close to her nest in the manner of the sentinel Brown Jay.

I found Magpie-Jays far more shy at their nests than Brown Jays. The wariness of those in the middle Motagua Valley contrasted sharply with the confidence of their brown relatives less than a hundred miles downstream. The extreme timidity of the Magpie-Jays about El Rancho frustrated my attempts to study their nest-life in pastures where I was a trespasser and accordingly handicapped in using a blind. But at one nest I watched the female incubate for more than 95 minutes continuously, when only two of her four eggs had been laid. The male fed her on the nest and twice stood guard on the rim while she was away, once for six and once for twelve minutes. This female also drove another of her kind from the nest-tree—something I never saw a Brown Jay do. But the trespassing Magpie-Jay was reluctant to go and eluded the pursuer by hopping from branch to branch in

the same tree. Great-tailed Grackles (*Cassidix mexicanus*) were chased if they came within 50 feet of the nest.

Helpers at the nest have been discovered in several other species of the Corvidae. A pair of Central American White-tipped Brown Jays may be assisted in their nesting operations by from one to five unmated helpers, which can in many instances be distinguished individually by the peculiar distribution of yellow and black on their bills, naked orbital rings, and feet; apparently these are yearling birds who will not breed until two years old. These helpers may occasionally bring a stick to the nest during construction and feed the female while she builds or incubates; but they are chiefly in evidence after the young hatch, when they bring food and guard the nest as zealously as their parents (Skutch, 1935:261–265). Grimes (1940:433–435) found three adults bringing food to a nestful of young Florida Jays (*Aphelocoma coerulescens*), and at least two of them took turns at brooding. Three American Crows (*Corvus brachyrhynchos*) fed the young at a nest in Connecticut (Forbush, 1927, 2:395). It would be interesting to know more details of the nest-life of the Australian White-Winged Chough (*Corcorax melanorhamphus*), of which it has been reported that a whole flock assists in building the nest (Mathews, 1925-1927:417), and also of the Tufted Jay (*Cyanocorax dickeyi*), at one nest of which Moore (1938:238–239) found three individuals whose mutual relations were most intimate—two of then even sat side by side on the eggs for a short period. The statement of Forbush (1927, 2:380) that Blue Jays (*Cyanocitta cristata*) "are said to care for the aged and infirm" is not out of keeping with what we know of the social habits of the Corvidae. The brief account given by Bent (1946: 118-120) of the nesting habits of the Arizona Jay (*Aphelocoma ultramarina*) suggested interesting forms of cooperation between a number of individuals; and later Gross (1949:242) watched seven or eight of these jays, including two yearlings, take part in building a single nest.

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Summary

The White-throated Magpie-Jay inhabits the more arid lowland districts of Central America and southern México. Its breeding season is extended, nests with eggs have been found in various parts of Central America from December to July. The nest, usually placed high, is a pile of coarse sticks holding a neat cup of wiry roots and fibrous materials. One clutch consisted

of four eggs. Apparently only the female incubates. While engaged in this duty she is fed not only by her mate but by other, apparently unmated, individuals. One female in Guatemala was nourished by certainly two and probably three or more other jays, who fed her 47 times in 13¾ hours. During this period she sat for intervals of from 25 to 88 minutes, took recesses of from one to 21 minutes, and covered her eggs 86.4 per cent of the time. So much food was brought to her that she found it unnecessary to hunt for herself, and devoted her short absences from the eggs largely to preening and stretching her limbs. Instances are given of helpers at the nests of a number of other species of Corvidae.

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Finca 'Los Cusingos,' San Isidro del General, Costa Rica, January 29, 1953

AUDIO-SPECTROGRAPHIC ANALYSIS OF THE SONGS OF THE ALDER FLYCATCHER[1]

BY PETER PAUL KELLOGG AND ROBERT CARRINGTON STEIN

It is generally recognized that Alder Flycatchers (*Empidonax traillii*) in the eastern United States have more than one song. Differences in song types have been described, but McCabe (1951) indicated that while two song types exist, there is very little agreement about the verbal description of these songs. These differences in description McCabe attributed primarily to differences in human interpretation. We would further suggest that there may be a basic difference in what individuals hear, which points up North's (1950) suggestion that all observers should check their response to audio-frequencies as a means of obtaining a better understanding of descriptive differences. A third possibility, as suggested by McCabe, is that there may be more than two recognizable song types used by Alder Flycatchers. Snyder (1953) agrees that there are two distinct types of regular song east of the Rockies and that each covers a broad geographic range.

In beginning this preliminary study, we selected four songs from the bird song collection at Cornell, one each from four different Alder Flycatchers, two of the *fee-be-o* type and two of the *fitz-beu* type. With the two songs of each type, an effort was made to select samples separated as far as possible in both time and space, since this would give us the best opportunity to observe differences. With the *fee-be-o* song, one example chosen was recorded at Ithaca, New York, May 30, 1952, probably of a migrating bird, and the other was recorded at Bay Pond in the Adirondack Mountains of New York on June 22, 1941, a separation of 200 miles in distance and 11 years in time.

One of the *fitz-beu* songs was recorded on June 7, 1947, at Ithaca, while the other was recorded at the Lower Souris National Wildlife Refuge, North Dakota, on June 12, 1949, a separation of 1200 miles in distance and two years in time.

The four songs thus chosen were analyzed with an audio-spectrograph and the results are shown in Figures 1 and 2. This technique is described and discussed by Potter (1945, 1947) Koenig *et al.* (1946), Joos (1948), and Bailey (1950).

The clear-cut differences between the songs of different types and the surprising similarities in the songs of widely separated individuals singing the same type of song, suggest the possibility that this method of study may have much use in clarifying the confusion concerning this group of birds.

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[1] The cost of publishing this paper has been met by subsidy.

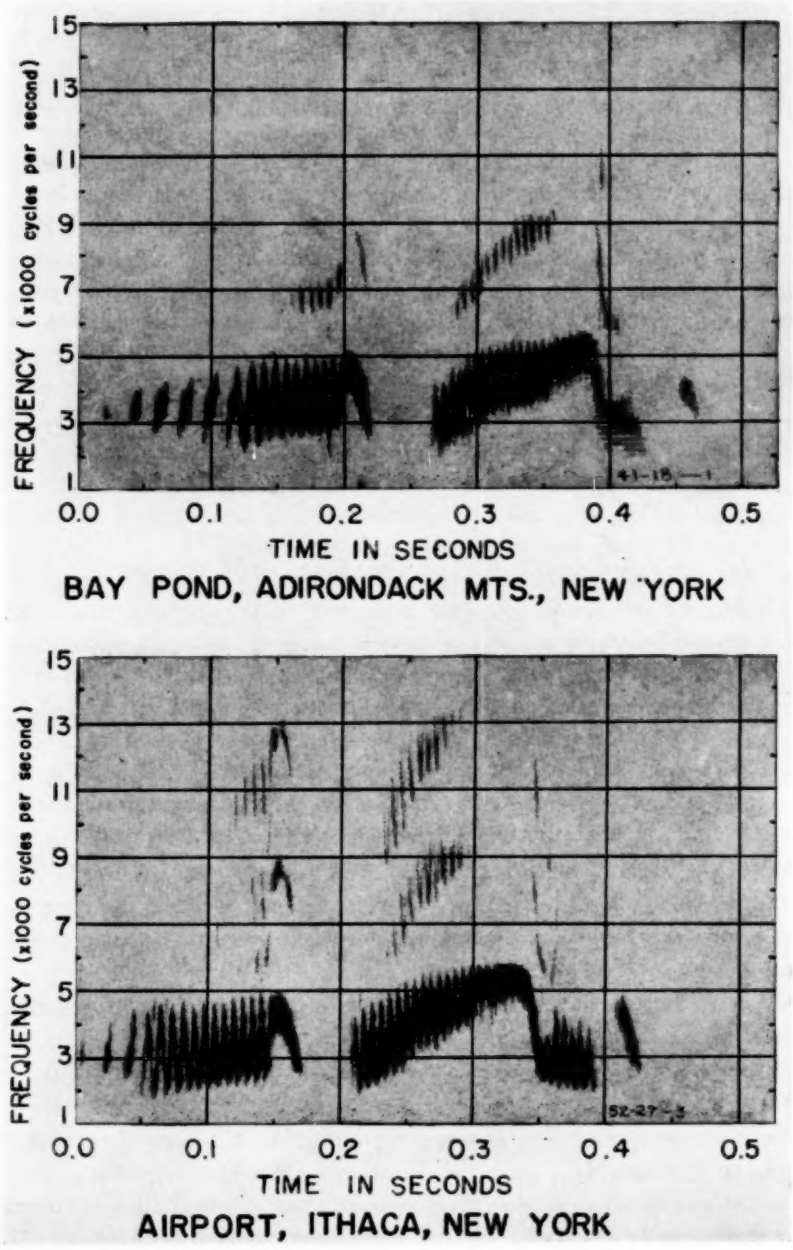

FIG. 1. Audio-spectrographs of the *fee-bee-o* song of the Alder Flycatcher.

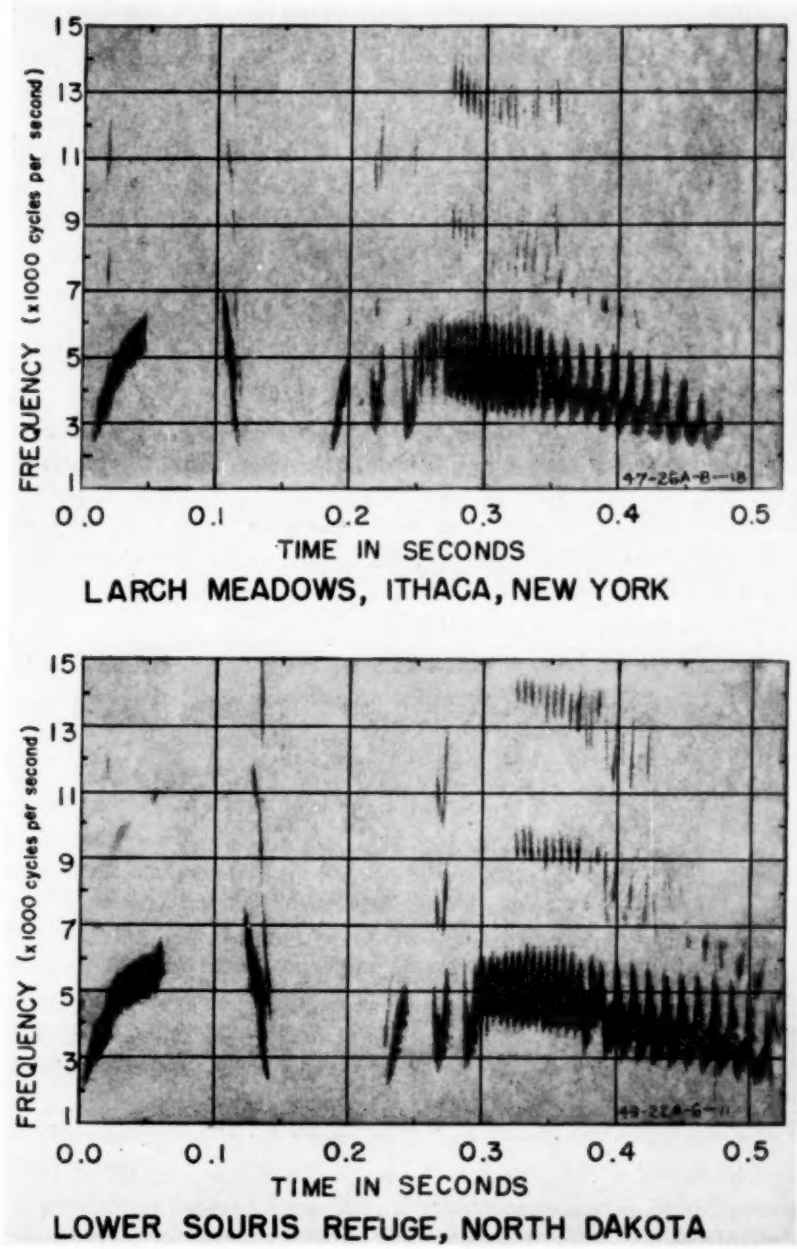

FIG. 2. Audio-spectrographs of the *fitz-beu* song of the Alder Flycatcher.

The following observations on the spectrograms should be of interest:

1. *Frequency Scale.* This vertical scale is linear rather than the logarithmic musical scale. While accurate, this scale appears to distort the musical values of the recording. This is especially noticeable in the harmonics or overtones which are shown as faint replicas of the song at double or triple the fundamental frequencies. These harmonics appear to change pitch faster than do the fundamentals. In a musical scale these octaves would all be equal and the lines of harmonics would all be parallel.

2. *The horizontal time scale* shows that the songs presented vary in length from a little over 0.4 seconds to a little over 0.5 seconds. The *fitz-beu* type of song is slightly longer than the *fee-bee-o* type, but there is considerable individual variation in the length of notes and in spacing.

3. *Filter Band Width.* These spectrograms were made by inspecting each song over and over again with a variable filter. This filter passed a band of frequencies 300 cycles wide at the half-power points. This filter band width results in a picture of the frequencies present slightly wider than it actually should be. However, this broadening of the picture is not serious and seldom amounts to as much as 1/16 of an inch added to the top and bottom of the trace, as presented here.

4. *Volume or Loudness Range.* This method of presentation does not give a good indication of the intensity of different parts of the song. To some extent intensity is indicated by a difference in the grayness or blackness of the trace. Other techniques of indicating the intensity range are available and will probably be combined with the present technique in some manner as this study progresses.

5. *Similarities of Song Types.* Both songs are characterized for the most part by a very rapid succession of tones (notes), alternating between a higher and lower frequency or pitch. These changes in pitch take place in short time intervals; from about 40 or 50 changes per second to nearly 200 changes per second. The pitch changes of these rapidly uttered notes may be as much as an octave, and probably account for the rough or reedy quality of the songs. These pitch changes are not necessarily perceived by the human ear as individual notes, since they occur so rapidly.

Both songs begin and end on a frequency close to 3000 cycles per second.

6. *Differences of Song Types.* In the *fee-bee-o* type song (Fig. 1), the first note is long, gradually increasing in frequency as much as three or four musical intervals, and finally terminating in an abrupt downward slur to about the starting pitch. The second note, clearly separated from the first, begins on about the same pitch as the first, but rises more rapidly, traversing about

six full intervals of the musical scale and then drops abruptly to the starting point and continues in what is probably interpreted as a third short note of gradually descending pitch. A fourth, very brief note or click of descending frequency is obvious on all of our spectrograms. This final note is probably not of audible importance but it may prove to be of interest in critical analyses.

In the *fitz-beu* type of song (Fig. 2), the first note appears to be sharp and short, rapidly rising in pitch about a full octave. This first note is followed by one of descending pitch with a drop of more than an octave. These two short notes, taken together, probably produce the sound usually referred to as *fitz*. Or should we say, *fitz-it*? The next note, usually thought of as the second, begins in a ragged or buzzy manner with the pitch increasing rather rapidly three or four full tones and then gradually decreasing in pitch to about the starting point or slightly below and becoming more buzzy towards the end.

7. *Differences in Individual Songs of a Type.* These differences are observable and may later prove useful in the study of individual variation. At present they appear to be over-shadowed by the similarity in songs of the same type.

8. *Harmonics or Overtones.* These are observable in all of the recordings as fainter partial repetitions of the song at double or triple the original frequency. Since it would be possible to produce these effects by a distortion of song at any of the several steps between the original song and the final trace on the spectrograph, further study and a better understanding of the equipment will be necessary before much confidence can be placed in any interpretation of these harmonic traces. It is of interest, however, that the Bay Pond spectrogram (see Fig. 1) shows fewer harmonics than any of the other traces. A possible explanation of this is that the recording equipment used in 1941 did not respond well to frequencies above 9000 cycles per second.

As an aid to further study of the songs analyzed in this paper, the actual recordings are, or will be, made available on phonograph discs. The song presented from Bay Pond is the first Alder Flycatcher song appearing on record 1-B of Volume 1, "American Bird Songs" (Kellogg and Allen, 1941). The other three songs will be published in a revision of Volume 1, or tape copies for study can be obtained from the Laboratory of Ornithology at Cornell University.

The preliminary nature of this study should be emphasized. Plans are being made for an intensive study of the songs of the eastern forms of this species in the near future. Cooperation in the form of recordings from any part of of the United States or Canada is invited.

Summary

Songs of four individuals of *Empidonax traillii* were recorded and analyzed on an audio-spectrograph. The four spectrograms, two of the *fitz-beu* type and two of the *fee-bee-o* type are presented. The spectrograms show great similarity in the songs of different birds singing the same song type and conspicuous differences in the two song types. The actual recordings on tape are available from Cornell for further study, and these are, or will presently be, published on phonograph discs.

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Laboratory of Ornithology, Department of Conservation, Cornell University, Ithaca, New York, March 30, 1953

THE QUESTION OF TEN-DAY INCUBATION PERIODS

BY MARGARET MORSE NICE

THE EGGS of a number of birds have been reported as hatching in ten days or even less. These short incubation periods are reported in two connections. One is the baffling method of some authors of counting incubation from the laying of the last egg to the hatching of the first egg—the so-called *Kurzbrutdauer*, which Swanberg (1950:65) rightly calls "meaningless." The other is the genuine belief in a particularly rapid development of the embryo in the species in question. It is the latter question that I propose to discuss here.

First, we must have a definition of incubation period. Here we may well follow Swanberg (1950:75) who adopts Heinroth's (1922) rule: *By incubation period is understood the time which, with regular, uninterrupted incubation of a newly laid egg, elapses until the young has left the egg.* In nature this can be checked by counting the time from the laying of the last egg to the hatching of the last egg, when all eggs hatch. This criterion is used by Moreau (1940), Nice (1937a), Skutch (1945), Sutter (1946), and many others.

A firm conviction has existed that little birds must have short incubation periods. Yet before the 19th century I can find no published statement of an incubation period shorter than 11 days. Audubon (1831:251) seems to have been the first to report a ten-day incubation period and this was for the Ruby-throated Hummingbird, *Archilochus colubris*: "Ten days are required for their hatching. . . . In one week the young are ready to fly, but are fed by the parents for another week." The male feeds his mate and "hurries the Bluebird and the Martin to their boxes . . . all these proofs of the sincerity, fidelity, and courage, with which the male assures his mate of the care he will take of her while sitting on her nest." It is clear that the whole story was spun out of his head; the male does not feed the female or the young; he takes no interest in her nesting; she incubates for 16 days; the young are fledged in 21 to 24 days (Kendeigh, 1952). Audubon's misstatements concerning incubation and fledging periods were incorporated into Nuttall's volume (1832) and appeared without change in the 1840 edition and also in "The Popular Handbook," edited by Chamberlain that came out in various editions from 1891 to 1919. Audubon's figure of ten days was given by Evans (1891) and copied by Bergtold (1917).

Others believed hummingbirds must have even shorter periods. A. E. Brehm (1861:262) suggested that "Hummingbirds perhaps need hardly eight days." Gentry (1876, 1882) stated that the female Ruby-throat incubates

eight days, the young leave at eleven days, both parents build the nest, and both feed the young.

The first European bird to be credited with a ten-day incubation period appears to have been the Wren, *Troglodytes troglodytes*. In 1841, Yarrell wrote, "The young are hatched after about ten days' incubation, during which time the male feeds the female" (1841:176–177); both statements are incorrect. This abbreviated period appears in the lists of Davy (1863:750) and Owen (1866:257). Evans (1891) quotes Yarrell and Owen, while Arrigoni degli Oddi (1902:48; 1904:130) gives Evans as his authority. The European Wren really incubates for 14 to 16 days (Niethammer, 1937; Witherby, *et al.*, 1938).

It is not only very small birds that have been said to hatch in short order. One of Gigliogli's (1890:187) correspondents assigned eight days to the Cirl Bunting, *Emberiza cirlus*, both European kinglets, *Regulus*, and four of the Sylviidae, birds that really incubate 12 to 16 days. The same correspondent also gave 10 days for 20 passerine species and 10 to 12 instead of 18 (Heinroth, 1922) for the European Quail, *Coturnix coturnix*. (In the same volumes other correspondents gave ridiculously *long* incubation periods for many of these same birds.) Even seven day incubation periods have been reported in this country: White-eyed Vireo, *Vireo griseus* (Dugmore, 1900), and Hutton's Vireo, *Vireo huttoni* (Wheelock, 1904); seven days is about half the actual period in these species.

Ten day incubation periods were given for 7 species by Gentry (1876), for 15 North American species by Burns (1915), and for 28 species (half of them from Burns) of birds of the world by Bergtold (1917). Groebbels (1937) gives a few among the two thousand or so of the incubation periods he quotes. Kendeigh (1952: table 51), in summarizing incubation periods of 107 families, gives none. Nowadays it is chiefly our sparrows and warblers that are supposed to develop so quickly.

It would be wearisome to deal with many of these guesses, most of them on species that have been found to incubate from 11 to 14 days or longer. Most of these records have something uncertain about them, usually some assumption as to the start or finish of incubation. This is true of Skead's (1952) ten-day incubation periods of the Bronzed Cuckoo, *Chrysococcyx caprius*, and of Gross' (1921) and Crabb's (1923) ten days for the Dickcissel, *Spiza americana*, while Bowdish (1906) does not state whether all five eggs of his Blue-winged Warbler, *Vermivora pinus*, hatched. In some cases, although the dates published plainly give eleven days between the laying and hatching of the last egg, the authors say incubation lasted ten days; examples are: Robert's Yellow Warbler, *Dendroica petechia* (1932:210), Dubois' Horned Lark, *Eremophila alpestris* (1935:58), and Wright's Blue-winged

Warbler (1909)—"ten or eleven days," interpreted by Bergtold as 10-14 days. Skutch (1945) said the Ruddy Quail-dove, *Oreopeleia montana*, hatched in ten days but later (1949) found it to be over eleven.

With two non-passerine species there are records which appear to be well-authenticated cases of ten day incubation periods. In his intensive study of the development of the Great Spotted Woodpecker, *Dendrocopos major*, Bussmann (1946:146) recorded six eggs laid April 26 to May 1; four young hatched May 10, and the last two were out by 10 a.m. May 11. Spencer (1943:14) observed 10 and 11 day incubation periods in nests of the Black-billed Cuckoo, *Coccyzus erythropthalmus*. A nest with one egg was found July 2, additional eggs were laid July 3 and 6, the last hatching July 16. The other nest also contained one egg when found July 7; other eggs were laid July 8 and 10, the second egg of the set hatching July 19.

Woodpeckers are well-known to have short incubation periods (Heinroth, 1922), hatching in a slightly less developed state than most altricial nestlings. The Black-billed Cuckoo egg that hatched in ten days was laid three days after the previous egg; it may have been retained in the oviduct for an extra 24 hours and thus have been at a more advanced stage when laid than the egg that hatched at 11 days.

It is neither a woodpecker nor a cuckoo, however, that is the most famous example of a reputed ten-day incubation period. Two passerines vie for the distinction of holding the record for "the shortest incubation period of any bird"—the White-eye and the Cowbird.

Incubation Period of *Zosterops*

White-eyes or Silver-eyes, of the family Zosteropidae, are small birds, four to five inches in length. The family, comprising one genus and 80 species, is widely distributed throughout Africa, southern Asia, Australasia, and many islands of the Pacific. White-eyes have long been cited as having the shortest incubation period of any birds—nine to ten days. We find this statement in books and articles from New Zealand and Australia to England, France, Germany, and North America.

What is the basis of this belief? Its source is a statement by Buller in his "History of the Birds of New Zealand" (1887–8, 1:86) in regard to *Zosterops caerulescens* (=*lateralis*)—a bird self-introduced from Australia—"Mr. Potts informs me that, in Canterbury, this species begins nesting early in October. In one instance, within his observation, the birds commenced incubation on October 16, the young were hatched on October 25, and left the nest on November 4." We are not told when the nest was found nor when the eggs were laid.

This supposed nine-day period might well have passed unnoticed, as so many statements, bad and good, have been, had it not been for William Evans, who published an important and influential review of incubation periods in *The Ibis* in 1891. He said: "The shortest period I have seen recorded is that of the tiny New Zealand *Zosterops caerulescens*, namely 9 to 10 days, as given by Buller on the authority of Mr. Potts, evidently a careful and systematic observer" (this characterization of Potts being quoted from Buller).

This 9-10 day period was included in Gadow's (1891) resumé of Evans' table. Campbell (1901) in "Nests and eggs of Australian birds" noted that "Mr. Potts observes that incubation in the case of the White Eye lasts about ten days." Bergtold (1917) quoted 9-10 days from Evans and 10 days from Campbell.

A ten day incubation for *Zosterops* received support from reported experiences in some aviaries. Perreau (1911) wrote that "incubation lasted ten days" with his pair of the Indian White-eye, *Z. palpebrosa*, but gave no details. Page (1911) gave June 27 as the date of finding the nest of his pair of the same species with its full complement of three eggs which hatched ten days later: "I regret that my data are somewhat modified by the fact that the birds had commenced to incubate, but I think it may be safely assumed that they had but just begun their incubatory duties when the nest was discovered." He reported the same event in another journal (1912a), saying his data were "somewhat doubtful." Bergtold quoted from Page's book (1912b) the period of 10-11 days for *Zosterops palpebrosa*.

The African White-eye, *Z. virens*, bred in Lovell-Keay's (1915) aviary. The date of laying of the first egg is given, but not the date of hatching: "The incubation period is almost exactly 10 days, certainly not more, as I watched the hen feeding 11 days after the first egg was laid." Neunzig (1921:130) gave the incubation period of the Cape White-eye, *Z. capensis*, as 10 days, but with no details or authority. Note that the only aviculturist who gave the date of hatching was not sure of the date of laying.

To return to the Antipodes, Oliver (1930) stated that the period of incubation of *Z. lateralis* in New Zealand "as observed by Mr. Wilkinson of Kapiti Island is ten days," and this was reiterated by Mrs. Wilkinson in 1931. Serventy and Whittell (1948) wrote in regard to the Silver-eye, *Z. australasiae*, "Incubation takes 9 to 10 days"; in 1951 they say "9 to 12 days." The nine to ten-day period for *Zosterops* has been quoted far and wide. To give only two examples: Baerg (1941) tells us, "The shortest period on record is nine days, for the Silver-eye of Africa," while Grassé (1950:614) writes "*Zosterops* furnishes us with the lowest figure with ten days."

Zosterops is a widely distributed genus, abundant in some places. What careful studies have been carried out on its nesting?

Schmitt (1931) bred *Z. japonica simplex* in his aviary in Hungary. The birds attempted seven nestings in three years, the eggs hatched in five cases. Many details are given of behavior and development. Schmitt says, "After eleven days the naked young hatched."

In New Zealand, Fleming (1943) made a study of the Silver-eye based on color-banding. He watched two nests. "In one case the time from the appearance of the last egg of three to the hatching of the last chick was 11 days (± 12 hours): in another clutch of two eggs the same period was 12 days (± 12 hours). In the former instance each egg had 10 days' incubation, and the two oldest hatched a day before the third."

Mr. Fleming kindly looked up his original notes and wrote me (June 3, 1952) that in the "Swing" nest the eggs were laid October 12-14, two young hatched October 24 and the third October 25. In the "Eugenia" nest the eggs were laid October 29 and 30 and both hatched November 11. "I think that the period for the 'Swing' pair is 11 days, not 10 as published, and for the 'Eugenia' nest 12 days. Please use these data and correct my misstatement. It would always pay to publish actual data!"

Mr. Robert Stidolph of Masterton, New Zealand, gave me an important record from the notes of Mrs. Wilkinson on a nest watched by her after her 1931 paper had been published. She made daily visits to it from November 20, 1931; the three eggs were laid November 23, 24, and 25; on December 5 no eggs were hatched, but on the 6th there were two young. One egg did not hatch. This gives a minimum period of eleven days.

As to Australia, Dr. Serventy wrote me on June 28, 1952: "The incubation period of *Zosterops australasiae* in our book appears to be an error. The only definite records which I can personally give are 12 days."

After I had traced the course of the nine to ten-day tradition for *Zosterops* as outlined above, I received very interesting information from Mr. W. R. B. Oliver of Wellington, New Zealand. He quoted two statements made by Thomas Henry Potts himself. In 1870 Potts published an account of a newly finished nest of *Zosterops lateralis* found December 4, which he visited daily: "On the 8th it contained three eggs; the next day a fourth egg was laid; on the 19th one callow nestling was exhibiting its ugliness. . . . The day following his ugliness had a companion." The other two eggs did not hatch. Mr. Oliver comments: "This account shows that the minimum incubation period is 11 days. And if the eggs laid presumably on the 5th and 6th were the ones that hatched, the incubation period would be 13 days."

Strangely enough, in 1884, Potts wrote that in this species, "Incubation lasts about ten days." Between 1870 and 1884 he must have found the nest

that started all the trouble; he assumed that incubation had just begun and evidently had forgotten his own daily observations on the first nest.

So here in four nests of the New Zealand Silver-eye recorded from 1870 to 1943 and in five nests of *Z. japonica simplex*, incubation was found to last at least 11 days, and in *Z. australasiae*, 12 days. The original nine day period was based on a guess as to when incubation started and the same was true of the ten day period reported by Page in his aviary. Perreau's and Lovell-Keay's statements appear to be of the same character. Mr. Oliver (personal letter) in his new edition of "New Zealand Birds" is "giving eleven days, occasionally twelve, as the time taken to incubate the eggs of the Silver-eye."

Incubation Period of the Cowbird

The tradition of the ten day incubation period of *Molothrus ater*, like that of *Zosterops*, is traceable to two sources, both ambiguous. Alexander Wilson (1810:145) was the first ornithologist to publish on the parasitic habit of the species; he observed it himself and had been told "in a vague way, that the Cowbird laid in other birds' nests. . . . From twelve to fourteen days is the usual time of incubation with our small birds; but although I cannot exactly fix the precise period requisite for the egg of the Cow Bunting, I think I can say almost positively, that it is a day or two less than the shortest of the above-mentioned species!" He quotes from the experiences of his friend, Dr. Nathaniel Potter of Baltimore, who tried to determine the incubation period, but the two nests he was watching came to grief. In his third attempt, "Being obliged to leave home, I could not ascertain precisely when the process of incubation commenced, but from my reckoning, I think the egg of the Cowbird must have been hatched in nine or ten days from the commencement of incubation. . . . I ought to acknowledge here, that in none of these instances could I ascertain exactly the time required to hatch the Cowbird's eggs" (p. 158). All this was repeated in each edition up to the last in 1879, but I can find no quotations of this presumed nine to ten day incubation period.

In the meantime Audubon (1831:497) had given the incubation period as "nearly a fortnight," although he also said, "In every case the Cow Bird's egg is the first hatched." This period was quoted by Evans (1891) and by Bergtold (1917) who attributed it not to its original source but to Evans; otherwise it appears to have been ignored.

The next year Nuttall (1832:192) wrote: "the young of the Cow-bird, I believe, appears about the 12th or 13th day of sitting," and this was reprinted until 1919. I cannot find that this guess made any more impression than Wilson's shorter and Audubon's longer guesses. I have not found the subject mentioned in any other 19th century book until Bendire.

Bendire evidently was the main source of the ten day belief, as he was of so many of our statements as to length of incubation. Whether he was influenced by Wilson we cannot say; he very seldom mentioned sources for any of his assertions. In "The Cow-birds" (1895a) he said that the egg "usually hatches in from ten to eleven days." He quoted M. A. White of Matthews, Virginia: "It was on the 9th of June, 1891, that I placed a fresh egg of the Cowbird in the nest of a Chipping Sparrow containing two of her own that had an advance of one and a half day's incubation. About the 19th Mr. Cowbird emerged from his prison walls, large and vigorous. A day later a little sparrow came forth from his delicate shell." The same story is repeated verbatim in Bendire's "Life Histories of North American Birds" (1895b:438). There are two ambiguities here. We do not know when the Cowbird's egg was laid; the "fresh" egg might have already been incubated for a day or two. And why "*about* [italics mine] the 19th"? All in all, a shaky foundation on which to base a categorical assertion.

Many books now began to give the incubation period of the Cowbird as ten days, although no one cited evidence or even any authority. Coues had given no incubation period for this species in his first four editions from 1872 to 1892, but in his fifth in 1903 he said 10 or 11 days. Knight (1908) gave 10 days, Eaton (1914) "about ten," Burns (1915) 10, Forbush (1927) 10-12, Roberts (1932) 10, and Chapman, who from 1897 to 1912 had not mentioned the matter, wrote in 1932 "ten days, about the shortest period of any of our passerine birds."

Unfortunately Friedmann accepted the consensus of opinion. He even wrote a paper (1927) on "A case of apparently adaptive acceleration of embryonic growth in birds," giving the incubation periods of the South American cowbirds as 11½ to 13 days, but of *Molothrus ater* as 10 to 10½ days. "No bird in the world is known to have a shorter incubation period; few have one as short." In his book, "The Cowbirds," (1929:187) he says, "The incubation period of the Cowbird is ten days, about the shortest of any of our passerine birds."

All this time collectors were collecting sets with Cowbird eggs, while other observers regularly removed the abhorred object. Friedmann (1929:305) wrote of "the great number of bird-students and bird-lovers who invariably, and not without some reason, throw out Cowbird eggs when they find them." This "enemy [that is, the egg-removers] also affects nestling Cowbirds and in regions where nature study is commonly indulged in, this class of enemies is of no small importance as a check upon the species." No one thought of verifying the accepted incubation period.

The first instance of leaving a Cowbird's egg alone and reporting when it hatched since the days of Dr. Potter and Mr. White seems to have occurred

at the Iowa Lakeside Laboratory on Lake Okobojii in 1917. On June 27, Nelle E. Shaver (1918) who was studying under Dr. T. C. Stephens, found a nest of the Maryland Yellow-throat, *Geothlypis trichas*, containing three eggs of the host and one of a Cowbird. The nest was visited daily and on July 8 the Cowbird was hatched and on July 9 two of the Yellow-throats were hatched. This gives an incubation period of at least eleven days for the Cowbird. No one seemed to notice that it was longer than it should have been. Eleven years later Hoffman (1929) reported a Cowbird egg in the nest of a Song Sparrow, *Melospiza melodia*, hatching in twelve days, the host eggs hatching in thirteen.

Up to this time I had been one of the Cowbird-egg-removers, but when I started my study of Song Sparrows, I realized that I should not interfere. To my astonishment I found the Cowbird *never hatched in ten days*. I first published my observations in 1933, saying that with the Song Sparrow as host Cowbird eggs hatched in slightly over eleven or twelve days, occasionally more, never less (p. 594). Four years later (1937a:153) I wrote: "It has long been believed that the one respect in which *Molothrus ater ater* was specialized was that of a short incubation period—'only 10 days.'" With the Song Sparrow as host Cowbird eggs hatched as follows: 5 eggs in 11 days, 9 in 12, 3 in 13, and 2 in 14, an average for the 19 of 12.1 days. Twice again (1937b, 1939) I crusaded against the myth of the Cowbird's ten-day incubation period.

Packard (1936) found on May 25 two Cowbird and four Black-capped Chickadee, *Parus atricapillus*, eggs in a nest box; on June 6 the Cowbirds hatched, on June 8 two chickadees, making a twelve day incubation period for the Cowbird. In his detailed study of the Ovenbird, *Seiurus aurocapillus*, Hann (1937:204) found "that the incubation period of Cowbird's eggs ranged from approximately 11.1 days to 11.8 days, with an average of 11.6, which is 0.6 of a day less than the average for the Ovenbird's eggs." Dr. Hann writes me that these averages are based on 15 Cowbird eggs. Finally, Norris (1947:95) in his study of Cowbirds with a variety of hosts writes: "I have recorded the incubation period accurately for only 10 eggs, but none of these hatched in 10 days. Five hatched in 11 days, one in 11.5 days, one in 12 days, two in 12.5 days, and one in 13 days. This gives an average of 11.6 days, exactly Hann's figure."

Thus, between 1918 and 1947 *47 records of 11 to 12 day* (and occasionally longer) *incubation periods were published for this species*, yet still the fable goes on. I have also received 15 unpublished records: 12 days in a Cardinal, *Richmondena cardinalis*, nest (Amelia Laskey), 11 days, 22 hours, 36 minutes in a House Sparrow, *Passer domesticus*, nest (W. E. Schantz), four 11 and three 12 day periods in Indigo Bunting, *Passerina cyanea*, Song Sparrow,

and Bobolink, *Dolichonyx oryzivorus*, nests (John L. George), and four of 11 days, one of 11-12, and one of 13 in Yellow-throat nests (P. B. Hofslund). Let us hope that these 62 observations of 11 days or more, and not a single one of 10 days, will make some impression.

Does the Cowbird's incubation period show any adaptation to parasitism? *Molothrus ater* and the Shining Cowbird, *Molothrus bonariensis*, (Friedmann, 1929:89) have similar periods—11 to 12 days. As to other icterids, at least two have equally short periods: Tricolored Red-wing, *Agelaius tricolor*, 11 days (Emlen, 1941:216), and Red-winged Blackbird, *Agelaius phoeniceus*, 11 days in twelve cases, 12 days in two cases, as reported to me by Edwin Willis of Baltimore, Maryland. I think we can answer our question in the negative.

Discussion

Thomas Henry Potts was an important ornithologist, called by Buller a "careful and systematic observer" and by Oliver (1930) "one of the truest naturalists New Zealand has had the good fortune to possess." Major Charles Bendire was a distinguished ornithologist, a founder of the American Ornithologists' Union, and Honorary Curator of the Department of Oology in the United States National Museum. The words of these men carried weight. People thought they were safe in believing such eminent authorities and the reported ten day incubation periods for *Zosterops* and the Cowbird were copied throughout the world.

Ten day incubation periods should not be lightly assumed; any such report should be accompanied with fullest detail and be scrutinized with extreme care. Very occasionally an egg may be retained for 12 to 24 hours in the oviduct (Sutter, 1946). Hoffman (1929) caught a Cowbird that appeared to be egg-bound and kept her over night; next morning he found two eggs in the cage. One of these eggs would have had an extra day of development before it was laid, and, if immediately incubated, might conceivably have hatched in ten days.

Let *Zosterops* and the Cowbird be a lesson to us. Leaders in ornithology must be especially careful of their pronouncements, for they have a heavy responsibility. And the rest of us must leaven our respect with a measure of skepticism. Instead of accepting everything in print we must demand the evidence and weigh it, and ourselves observe and experiment. Remember Louis Agassiz's precept: Study Nature, not books.

Summary

Incubation period can best be determined by counting the time from the laying of the last egg to its hatching.

Audubon in 1831 appears to have been the first ornithologist to assign a ten day incubation period to any bird. Since then many such assertions—and even of shorter periods—have been made both in the Old and New worlds, but authenticated incubation periods of less than 11 days prove to be rare.

Zosterops, the White-eye or Silver-eye, has attained world-wide fame for the shortest period of any bird—9 to 10 days. This rumor started in a careless observation in New Zealand in the 1880's. In eleven or more nests that have been carefully watched from 1870 to 1943 the incubation period lasted 11 to 12 days.

For sixty years Cowbird eggs have been stated to hatch in ten days—"about the shortest period of any of our passerine birds." This myth was started through a guess by a friend of Major Bendire and was generally accepted, although no good evidence was ever produced. From 1918 to 1952 there have been 62 cases reported of Cowbird eggs hatching in 11 to 12 days and not one case in ten days.

The unquestioned acceptance of these blunders for 60 to 80 years clearly shows that we need greater care in observation and less reliance on the printed word.

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5725 HARPER AVENUE, CHICAGO 37, ILLINOIS, OCTOBER 16, 1952

A PLIOCENE GULL FROM FLORIDA

BY PIERCE BRODKORB

FEW fossil gulls have been described and none is known from the Pliocene Epoch. The only Pliocene record for the Laridae as a whole is that of Wetmore (1944), who examined an undetermined tern from Kansas. Collections made by Mr. George C. Elmore in Middle Pliocene deposits of southern Florida include several specimens of a medium-sized gull which is described in the present paper.

Larus elmorei, new species

Type.—Distal end of right humerus, No. 140, collection of Pierce Brodkorb; Middle Pliocene (Bone Valley formation); one and one-half miles south of Brewster, Polk County, Florida, in Sec. 5, T. 32 S, R. 24 E. Collected February, 1952, by George C. Elmore (locality 2).

Description.—Shaft wide, somewhat flattened on anconal surface; olecranal fossa wide, gradually merging into shaft without abrupt depression; external tricipital groove pronounced; internal tricipital groove scarcely separated from olecranal fossa, except for a raised area at base of shaft.

Palmar surface of lower portion of shaft somewhat convex, for reception of *brachialis anticus*; brachial depression deep and wide, its external portion crossed by two complete and one incomplete diagonal ridges; ridge bordering internal side of brachial depression pronounced, the distal portion of the ridge with surface for attachment of anterior articular ligament broadened distally, and sloping distally and toward brachial depression; attachment for *pronator brevis* bounded by a raised area on summit of ridge, its surface sloping proximally; internal condyle a flat oval; external condyle diagonal, its distal end not extending quite as far as end of internal condyle; entepicondylar prominence well developed, with two depressions on its side; ectepicondyle large, extending at an angle of about 45 degrees from palmar surface, and situated relatively high on shaft, its proximal edge being in line with proximal boundary of brachial depression; a round scar for *supinator brevis* prominent at base of ectepicondyle.

Color white; well mineralized.

Measurements of the type humerus are the maxima in Table 1.

Comparisons.—Distal end of humerus most similar to that of Recent *Larus delawarensis* Ord. Differs in larger average size; in having the internal tricipital groove broader; internal condyle relatively shorter; brachial depression deeper; surface for attachment of anterior articular ligament broader and less sloping distally; surface for attachment of *pronator brevis* broader.

The fossil species is more distantly related to other living gulls. From *Larus canus*

brachyrhynchus Richardson it may be separated by its larger size; wider distal end; deeper brachial depression; relatively shorter internal condyle.

It differs from *Larus heermanni* Cassin in larger size; relatively shorter internal condyle; more projecting entepicondyle. *L. heermanni* has a deep brachial depression as in the fossil, but the distal end of the humerus is more compressed than in *elmorei*, with the entepicondylar prominence not visible in palmar view.

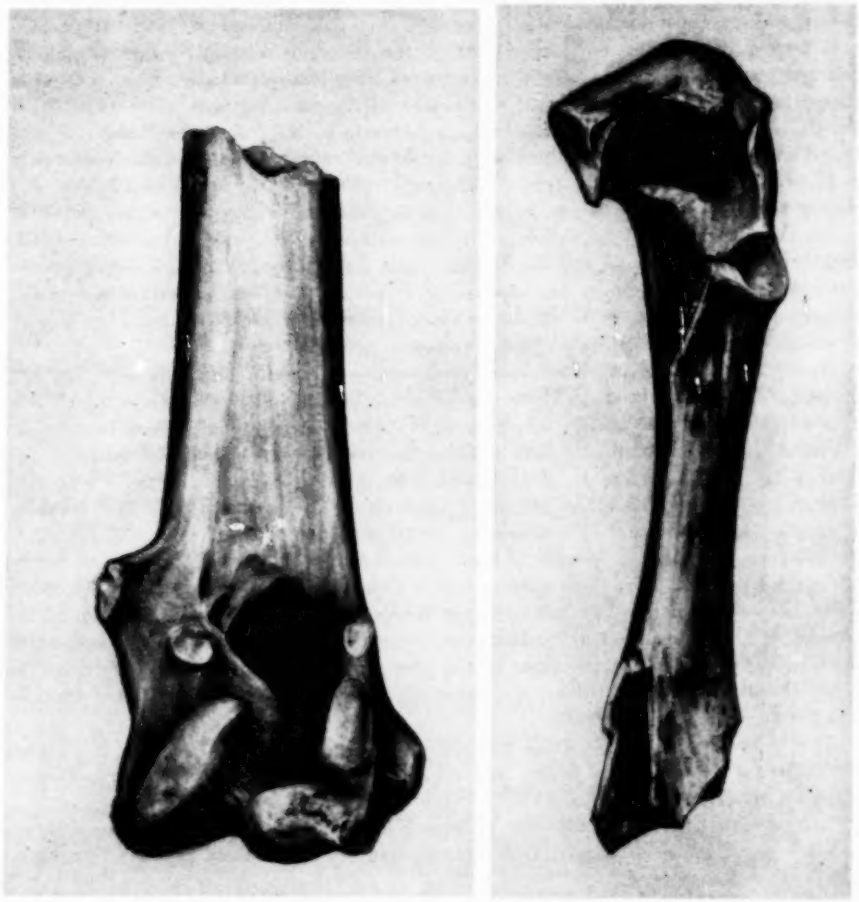

FIG. 1. *Larus elmorei*. Type humerus (left) and referred coracoid. Three times natural size.

The fossil may be separated from *Larus californicus* Lawrence by the smaller size and relatively wider internal tricipital groove in the fossil. Other living gulls are either considerably larger or smaller than the Pliocene species.

The new species differs from *Larus oregonus* Shufeldt (1892:398), of the Pleistocene of Oregon, in lesser width of distal end (15.3–16.0 mm. in *oregonus, fide* Howard, 1946:

186). Only the proximal portion of the humerus of *oregonus* has been figured (Shufeldt, 1892:pl. 15, figs. 3 and 4), so that other differences which may exist in the distal end are not known.

The humerus of *Larus robustus* Shufeldt (1892:398), of the Pleistocene of Oregon, is unknown. The type coracoid, however, is from a very large gull.

Larus vero Shufeldt (1917), of the Pleistocene of Florida, was based upon a carpometacarpus. According to Wetmore (1931:16) this bone came from a Yellow-crowned Night Heron, and therefore the name is a synonym of *Nyctanassa violacea* (Linnaeus). I have examined a cast of the type, No. V320 in the collection of the Florida Geological Survey. The cast shows some slight discrepancies from Shufeldt's figure. Apparently the tuberosity of the second metacarpal was broken off between the time of preparation of the figure and casting. The cast appears inaccurate in having more distal fusion between the shafts of the second and third metacarpals than appears in the figure. The only published measurement of the type is the length, which Shufeldt gives as 5.75 cm. My measurements of the cast are as follows: length 58.8 mm, height of proximal end 10.8, width through trochleae 5.3, width of second metacarpal 4.1, width of distal end 4.2, length of fusion of second and third metacarpals 8.8. It is obvious that *Larus vero* is not a gull, since it differs in the shape of the process of the first metacarpal and in the course of the tendinal groove. As far as can be determined from the cast, I agree with Wetmore that it is not separable from *Nyctanassa violacea*.

In the same paper in which he described *Larus vero*, Shufeldt (1917:38, pl. 1, fig. 12) listed *Larus*? (sp. ?) from the Pleistocene of Vero, Florida. The specimen on which this record is based is the distal half of a right tibiotarsus (not the tarsometatarsus as stated). I have studied this specimen, which is now No. V3500 in the collection of the Florida Geological Survey. It is not a gull, since it has the internal condyle relatively shorter, stouter, and with a less prominent notch on the distal end. The fossil came from a small duck and shows close similarity to the tibiotarsus of *Lophodytes cucullatus*. This raises the question of the identity of *Querquedula floridana* Shufeldt, the only currently recognized species of the three supposed new birds from Vero. Wetmore noted certain differences between the type humerus and that element in living *Anas* [*Querquedula*] *discors*. He has identified as *Q. floridana* material from other Pleistocene deposits in Florida. From a study of two casts of the type and other material I am struck by the similarity of the humeri to those of *Lophodytes*. This point will be elaborated upon in another connection at a later date.

The humerus of *Larus pristinus* Shufeldt (1915:54), from the Oligocene of Oregon, is unknown. According to Miller and Sibley (1941:566), the type tibiotarsus is of doubtful allocation.

Several species from the Oligocene of Europe have been described in the genus *Larus*. All are either larger or smaller than *elmorei*, and several of them probably should be referred to other genera.

Gulls from the Miocene are *Gaviota niobrara* A. H. Miller and C. G. Sibley (1941), from Nebraska, and *Pseudosterna dejener* and *P. pampeana* Mercerat (1879), from Argentina. In these genera the spur is located more proximally than in *Larus*. *Gaviota* differs further from *Larus elmorei* in much larger size, in smaller spur, and in having the scar for *pronator brevis* situated on the medial side of the ridge instead of on the summit.

Referred material.—Other material referred to this species includes three specimens from Elmore's Locality 1, in the NE corner of the NE ¼ of the SW ¼, Sec. 32, T. 31 S, R. 24 E, one and one-half miles southeast of Brewster, Florida.

TABLE 1

MEASUREMENTS (in mm.) OF *Larus elmorei* AND *Larus delawarensis*

	elmorei (1 or 2 specimens)	*delawarensis* (8 specimens)
Humerus:		
Proximal base of spur to end of external condyle	12.7 (12.4, 13.0)	12.3 (11.0–12.8)
Width across condyles	11.8 (11.5, 12.0)	11.6 (10.3–12.1)
Width of distal end	14.0 (13.7, 14.3)	13.4 (12.5–13.8)
Width of shaft above spur	9.1 (8.8, 9.3)	8.7 (8.3–9.2)
Width of inner tricipital groove	5.9 (5.5, 6.3)	5.1 (4.8–5.3)
Diagonal length of external condyle	8.4 (8.3, 8.5)	7.9 (7.3–8.4)
Length of internal condyle	3.8 (3.7, 3.9)	4.0 (3.7–4.2)
Depth of external condyle	8.1 (7.9, 8.2)	8.2 (7.6–8.5)
Depth of internal condyle	4.4 (4.3, 4.5)	4.2 (4.0–4.3)
Coracoid:		
Brachial tuberosity to furcular facet	4.4	4.2 (3.8–4.7)
Furcular facet to head	6.5	6.0 (4.6–6.8)
Head to glenoid facet	5.6	5.3 (4.8–5.7)
Glenoid facet to scapular facet	8.6	8.6 (7.8–9.2)
Furcular facet to glenoid facet (width of head)	10.3	9.6 (8.3–10.5)
Brachial tuberosity to glenoid facet	9.2	9.2 (8.5–9.7)
Head to scapular facet	12.7	12.3 (11.2–13.4)
Width of shaft through scapular facet	5.8	5.3 (4.8–5.6)
Narrowest transverse diameter of shaft	3.7	3.8 (3.4–4.1)
Narrowest depth of shaft	3.0	2.9 (2.6–3.2)
Breadth of furcular facet	9.0	8.4 (7.1–9.2)
Carpometacarpus:		
Width of second metacarpal	4.0	3.9 (3.5–4.1)
Height of distal end	6.8+	7.2 (6.4–7.8)
Width of distal end	5.5	5.5 (5.1–6.0)
Distal fusion of second and third metacarpals	6.3	6.1 (5.7–6.5)

The distal portion of a left humerus (P. B. No. 176) is similar to the type but comes from a slightly smaller individual. The spur has been broken off near its base.

The proximal three-quarters of a right coracoid (No. 134) resembles the corresponding bone in *Larus delawarensis*. It differs in being somewhat more robust; in having the internal border of the glenoid facet convexly oval instead of nearly straight; and in having the head of the bone relatively wider, particularly the median portion.

The coracoid of *elmorei* differs from that of *L. robustus* in much smaller size and in configuration of the head as described above.

The coracoid of *L. oregonus* has not been figured and has only briefly been described. From the ratios published by Howard (1946), it appears that the breadth of the furcular facet and the distance from the distal end of the scapular facet to head are less in *elmorei*.

The distal end of a left carpometacarpus (P. B. No. 178) is not separable from the corresponding element in *L. delawarensis*.

For the loan of specimens for comparison I am indebted to Dr. Robert O. Vernon of the Florida Geological Survey, Dr. Frank A. Pitelka of the

Museum of Vertebrate Zoology, and Dr. Herbert Friedmann of the United States National Museum. The drawings (Fig. 1) were made by Miss Esther Coogle.

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September 9, 1952

A LIFE HISTORY STUDY OF THE YELLOW-THROAT

BY ROBERT E. STEWART

DURING the spring and summer of 1938, I studied the habits and behavior of the Northern Yellow-throat (*Geothlypis trichas brachidactyla*) in southern Michigan. General observations were made throughout Washtenaw, Jackson, and Livingston counties, and detailed notes were obtained on a breeding population of Yellow-throats in a marshy area adjacent to Geddes Pond, one mile east of Ann Arbor. Nesting activities were studied from blinds placed within a few feet of active nests in the Geddes Pond area. Supplementary information on nest-building, egg-laying, and incubation periods of a closely related subspecies, the Maryland Yellow-throat (*Geothlypis trichas trichas*), was recorded at Arlington, Virginia, in 1940, and at the Patuxent Research Refuge near Laurel, Maryland, in 1947. Grateful acknowledgment is made to Dr. Josselyn Van Tyne for helpful advice given during the course of this study.

BREEDING SEASON

The resident male Yellow-throats were found to establish breeding territories almost immediately upon their arrival in the spring. At Ann Arbor, in 1938, the first record of a Yellow-throat in the spring was on April 29. On April 30, another was seen and on May 1, three were found with established territories adjacent to each other. The three birds were definitely resident males as they remained in their respective territories during the summer. They were easily recognized because of their distinctive songs. It would appear, therefore, that some of the resident males arrive on their nesting grounds at least as soon as, if not before, the transient males that nest farther north. Breeding territories were occupied and defended by male Yellow-throats from the time of their arrival in the spring until the advent of the post-nuptial molt which occurred during the first two weeks of August. At this time, territorial boundaries were no longer recognized and most of the Yellow-throats, even those still caring for young, wandered about a good deal.

In 1938, most female Yellow-throats arrived about one week after the first general appearance of the males. One lone female was seen on May 3, but this was, no doubt, an unusually early arrival as no others were seen until May 7. This early female was also peculiar in that it remained unattended by a male for over two weeks after its arrival although it was surrounded by males.

The first nest, containing eggs, was found on June 3. On June 7, another nest, containing nestlings, was located, while on June 10, a pair of Yellow-

throats was found tending young birds out of the nest. These records would indicate that the nesting actually started during the middle of May, probably about May 15. A nest with 4 eggs was reported near Ann Arbor on May 23, 1903 (Wood, 1951:417). July 27 was the latest date on which a nest with viable eggs was observed, and young birds were last seen as nestlings on August 3. From the evidence presented, I think that the period in 1938 during which occupied nests occurred extended from approximately May 15 to August 7. Adults were observed tending young out of the nest as late as August 20, and on August 29 an adult male was observed feeding a young Cowbird (*Molothrus ater*).

Habitat

The typical Yellow-throat habitat in southern Michigan develops on sites with damp or wet soil. It is characterized by a mixture of dense, rather lush, herbaceous vegetation and woody plants, chiefly shrubs and small trees. This type of habitat is usually found along the margins of streams, ponds and lakes, in open bogs, and in seepage areas below springs. In life form the habitats were found to range from an open savanna-like type with scattered groups of shrubs or trees from 3 to 15 feet in height, to a fairly dense thicket of small woody plants, usually less than 3 feet in height. Although definite evidence is lacking, it may be, as suggested by Kendeigh (1945b:430), that the habitat requirement of the Yellow-throat is the dense growth of low vegetation, which is more prevalent in wet areas, rather than the moisture itself.

Numerous species of plants characterize Yellow-throat habitats. The following names of some of the more numerous ones are taken from Gray's Manual of Botany (Fernald, 1950). Near Ann Arbor the more important woody plants include *Salix cordata*, hoary willow (*Salix candida*), speckled alder (*Alnus rugosa*), red osier dogwood (*Cornus stolonifera*), shrubby cinquefoil (*Potentilla fruticosa*), and buttonbush (*Cephalanthus occidentalis*). The many kinds of herbaceous species were found to be extremely variable in their occurrence and abundance from one area to another. In the Geddes Marsh area the more important herbaceous species are as follows: *Dryopteris Thelypteris, Sphenopholis intermedia, Glyceria striata, Leersia oryzoides, Calamagrostis canadensis, Carex cristatella, Carex stipata, Carex vulpinoidea, Carex steralis, Carex stricta, Carex leptalea, Eleocharis palustris, Juncus Dudleyi, Juncus nodosus, Thalictrum polygamum, Anemone canadensis, Fragaria virginiana, Desmodium* spp., *Pycnanthemum virginianum, Pedicularis lanceolata, Galium boreale, Eupatorium purpureum, Eupatorium perfoliatum, Aster puniceus, Aster novae-angliae,* and *Solidago* spp. The pre-

dominant herbaceous plants are grasses, sedges, rushes, composites, and a few representatives of other families.

The local distribution of Yellow-throats overlapped the local ranges of numerous other species of birds. Since the areas occupied frequently included portions of marsh, sedge-meadow, shrub swamp, and forest edge, many of the associating species were those that are characteristic of these various habitat segregates. Due to the lack of uniformity of most of the areas occupied by Yellow-throats the species composition of birds was found to vary greatly from one place to another. The more common associating species were: Traill's Flycatcher (*Empidonax traillii*), Long-billed Marsh Wren (*Telmatodytes palustris*), Short-billed Marsh Wren (*Cistothorus platensis*), Catbird (*Dumetella carolinensis*), Yellow Warbler (*Dendroica petechia*), Red-winged Blackbird (*Agelaius phoeniceus*), Cowbird (*Molothrus ater*), Cardinal (*Richmondena cardinalis*), Indigo Bunting (*Passerina cyanea*), American Goldfinch (*Spinus tristis*), Eastern Towhee (*Pipilo erythrophthalmus*), Henslow's Sparrow (*Passerherbulus henslowii*), Field Sparrow (*Spizella pusilla*), Swamp Sparrow (*Melospiza georgiana*), and Song Sparrow (*Melospiza melodia*). Other birds occasionally noted within Yellow-throat habitats include: American Bittern (*Botaurus lentiginosus*), Black Duck (*Anas rubripes*), Marsh Hawk (*Circus cyaneus*), Ring-necked Pheasant (*Phasianus colchicus*), Virginia Rail (*Rallus limicola*), and Sora (*Porzana carolina*).

Population

The Yellow-throat, one of the more common species of the warblers (Parulidae) that nest in the Ann Arbor region, varies greatly in abundance from one area to another, depending on habitat conditions. A census of breeding Yellow-throats in the Huron River valley was conducted in an area comprising six adjoining sections (six square miles) that extend eastward from Ann Arbor. These sections were covered systematically on foot and all habitats that appeared suitable for Yellow-throats were thoroughly searched during several visits. Because of the intensive coverage, I think that the census totals are fairly accurate. The total number of territorial males in the entire area was found to be 58 (average of 9.7 males per square mile). These birds were unevenly distributed, being concentrated in their restricted habitats which occurred only along portions of the Huron River and its tributaries. An indication of this variation in occurrence and abundance is shown by the number of territorial males in each of the six sections: 21, 10, 9, 9, 9, 0.

Although most of the areas of Yellow-throat habitat in this region are quite local and restricted in size, there are a few fairly large tracts that are popu-

lated by them. One such area, which covered a little more than one square mile was adjacent to Portage Lake in Jackson County. More than half of this area was made up of suitable habitat and here the birds were nesting in profusion. While no detailed census was made of this plot, I estimate that well over 100 territorial males were present.

In the Geddes Marsh study tract all of the habitat that appeared to be suitable for breeding Yellow-throats was occupied by them. This would indicate that the local breeding population in 1938 had reached the saturation point. The total area of suitable habitat was approximately 16 acres, while the number of territorial males present was 11. On the basis of these figures, the population density of territorial males on land that supports appropriate habitat is about 69 per 100 acres.

All of the 11 territorial males in the Geddes Marsh study tract were mated. One male was definitely polygamous, having two mates, while nine males were monogamous. The remaining male was also probably monogamous since not more than one female was seen in its territory at one time. However, two nests were found in its territory within a very short period which might indicate the presence of a second female. Young birds were fledged from the first of these nests on June 22 while on June 27 the other nest was found a relatively short distance from the first, containing two young Cowbirds and one Yellow-throat egg.

Songs and Call Notes

Upon their arrival in spring, the male Yellow-throats frequently sang while establishing their territories. The songs were then continued through summer until the advent of the post-nuptial molt in August. The latest adult song was heard on August 19. These songs apparently serve as proclamations of ownership of territory and, in the spring, probably also function in advertising the male's presence to any newly-arrived females.

The typical common song may be represented phonetically either as *wit-cha-ree, wit-cha-ree, wit-cha-ree, wit* or as *wheet-to, wheet-to, wheet-to, wheet-to.* However, there are many individual variations in the number of phrases, the number of syllables in each phrase, and in the tone and pitch. In the Geddes Marsh area, seven males had songs that were composed chiefly of three-syllable phrases while four males had songs made up of two-syllable phrases. The song of each male was distinctive enough to be readily recognized.

Ordinarily the males paused only momentarily to sing and then continued with whatever activity they were engaged in. Occasionally they stopped for a much longer period to sing, generally mounting to a perch several feet higher than usual, and there bursting forth in song at fairly regular intervals,

remaining stationary throughout. Mousley (1919) studied the relationship between location of favorite singing trees and nest sites. His observations on four nests showed distances between singing trees and nests of 4, 7, 10, and 11 yards. In the present study, most males were observed to sing in spurts, singing actively at fairly regular intervals for a considerable period and then abruptly ceasing to sing for another period. While actively singing, the interval between songs frequently was from 10 to 20 seconds with the period of song delivery lasting from 1.5 to 3 seconds. In mid-July, the total number of common songs sung by one male during nine hours of observation in the afternoon was 558 (an average of 62 per hour). The greatest number of songs recorded for this bird during one five-minute period was 26 (an average of one song every 12 seconds); the longest period of silence lasted for 85 minutes.

Male Yellow-throats were also occasionally observed performing flight songs. The procedure usually was for the bird to start from a perch in a low shrub, rise with undulating flight to a height of from 25 to 100 feet and then swoop downward to a new perch near the ground. During the ascending part of the flight the bird uttered several sharp, short notes which resembled the sounds, *teenk, teenk, teenk*. Near the apex of the flight, a somewhat discordant, garbled group of call notes, song phrases, "chuckles," and "gurgles" were uttered; during the descent the bird was completely silent. A modification of the typical flight song was noticed once when a male was observed singing the characteristic notes while flying to a perch near the top of a tall willow tree. The season of the flight song coincided with the season of the common song, although my records indicate that flight songs were given more frequently in late July and early August than earlier in the season. Usually more flight songs were heard in the afternoon and evening than in the morning. In nine hours of observation during which the songs of one male were recorded (see above) only 10 flight songs, or one flight song to 56 common songs, were given.

Another type of song which seemed to be more or less intermediate in character between the common song and flight song, was heard from a few adult males during the last half of July. This song was made up of a conglomeration of many unharmonious, squeaky, harsh, and melodious notes and was sung in diminished volume while the bird was perched. Several young males in first-winter plumage, were also heard singing similar songs during the first two weeks in September. Their songs were not very loud and lacked the well-balanced timing of the common song of the adult.

The vocabulary of call notes, which is shared by both sexes, is quite varied. Apparently many of these notes either have special functions or represent outward expressions of distinct "emotional states" of the bird. Probably the

most common of the call notes may be described phonetically by the sounds *stagt - stagt*. They evidently represent expressions of "suspicion" or "distrust" and sometimes of "annoyance." The sudden appearance of anything at all unusual or unnatural is likely to evoke an outburst of *stagts*. Sometimes a female when closely followed by a male will give vent to a few *stagts* as if she were annoyed with him. Often other birds of even smaller size were greeted with these notes when they approached a Yellow-throat too closely.

The harsh notes *ste-de-de-de-de-de-de-deet* are used by Yellow-throats when they appear to be communicating with each other. They are given in rapid succession and considerable effort seems to be involved in their utterance, as is evidenced by the noticeable vibration of the tail and lower part of the bird's body. Occasionally these notes are abbreviated to a mere *ste-deet*. They might be considered as being true call notes, since they are often employed by either sex in calling the mate. In spring, before the arrival of the females, these same notes were often used in verbal duels between two males in such a manner that they seemed to represent notes of challenge. Sometimes such a verbal duel would lead to actual physical combat. The use of these notes by a Yellow-throat as warning signals to its mate was also apparent since the presence of an enemy, such as man, seemed to furnish the stimulus for their delivery as if the bird were attempting to warn its mate of impending danger. The incubating female also appeared to use these notes as a warning to the male whenever he attempted to sing too close to the nest. If the male failed to heed the initial warning, the female would repeat the notes.

The alarm notes of the Yellow-throat may be represented by the sounds *steek-steek-steek* or *shtip-shtip-shtip* or *speenk-speenk-speenk*. They were uttered only when the bird was "alarmed" or "frightened," such as when the nests or young were approached too closely. The barely audible notes, *che-che-che-ca-r-r, ca-r-r, che-che-ca-r-r*, which are delivered in a slow and drawn-out fashion, might be considered to be "parental love" notes since they were often uttered by the parents while attending the young in the nest. Still another call, represented by the sounds *zee-eet, zee-eet, zee-eet*, was sometimes given by the adults when approaching fledglings with food.

Territories

The resident males, upon their arrival in spring, almost immediately began to establish their breeding territories. For one of the first arrivals, this seemed to be a rather simple procedure. The bird merely picked out a plot of ground which it deemed suitable, and then defended the plot against other males. This newly acquired "sovereignty" was proclaimed by almost continual song. For later arrivals the establishment of territories appeared to be

more complicated because much of the suitable habitat had already been claimed for territories by earlier males. As a result the late-comers often had to struggle vigorously to obtain adequate territories of their own. This often entailed a shifting of the boundaries of territories already established and sometimes resulted in a reduction in their size as well. In New York, Kendeigh (1945a:158) noted a period of territorial readjustment for second broods shortly after the first broods left the nest.

Observations of encounters between two established males along the border between their respective territories indicated that the males became extremely nervous and fidgety when they met. They moved quickly around each other, darting and alighting here and there, and at the same time displaying a peculiar flicking movement of the wings and tail. Ordinarily, while going through these antics the birds were completely silent, although on a few occasions one was heard singing a low, barely audible song. This display of rivalry apparently was usually mere "bluster and bravado" since actual physical combat was seldom noted. As a prelude to an encounter of this type the rapidly repeated challenge or warning notes were often uttered by both males when they were first approaching each other.

I seldom saw a male trespassing on another male's territory. When this happened, however, the intruder usually was soon discovered by the owner. Then the trespassing male was likely to retreat hastily with the other male darting after him and if the intruder was overtaken a short but vicious battle would ensue. In all cases observed the original owner emerged as the victor.

The territories of ten monogamous males in the Geddes Marsh study area were found to range in size from .8 to 1.8 acres (mean, 1.26±.12 acres; standard deviation, .39). The territory of the one polygamous male in the Geddes Marsh area occupied 3.4 acres—nearly twice as large as any of the others. The home ranges of the two females in this case were entirely separate from each other; the birds probably were unaware of each other's presence. This male's favorite singing perch was located near the top of a large dead tree midway between the home ranges of the two females. The male and one of his mates were color-banded in order to facilitate identification.

During most of the summer the male Yellow-throats seemed to be completely tolerant of neighboring species of birds. However, during early May, before the arrival of most of the females, the territorial instincts of the males were at a peak and as a result the birds were somewhat pugnacious, even toward other species. At this time male Yellow-throats were observed on a few occasions chasing four other species: Black-capped Chickadee (*Parus atricapillus*), Yellow Warbler, Field Sparrow, and Henslow's Sparrow. Yel-

low-throats were in turn observed being chased by Catbirds and Song Sparrows.

In only one instance did I see a male showing antagonistic actions toward a female. This took place while I was walking near a nest containing young birds. My presence caused such a commotion from the parent birds that a neighboring female was attracted to the spot. The attention of the two parents then was turned toward this new trespasser. The female parent became especially excited and soon both females were actively chasing each other back and forth through the area. The male meanwhile stood passively by, watching, and occasionally voicing his displeasure with a few characteristic *stagts*. Finally, as if losing his patience, he darted after the intruder with determination that could not be denied, forcing her to flee to her own territory.

Courtship

Courtship activities began as soon as the females arrived. Ordinarily after a few preliminary bouts between contending males along the boundary between their territories, the newly-arrived female chose her mate (or territory) with little delay, usually within a day or two. As soon as a male acquired a mate, he exercised a constant vigil over all of her activities for the next six or seven days, closely following her wherever she went. At this time the male frequently attempted to induce the female to copulate. Accompanying such attempts he was seen to exhibit the same peculiar flicking movement of the wings and tail as was seen in connection with the inter-territorial encounters between two males. In an experimental study on sex recognition in birds (Noble and Vogt, 1935:281), the male Yellow-throat was found to attack mounted male specimens and to attempt copulation with female specimens. However, when a black mask was placed on a female specimen, it was attacked, indicating that Yellow-throats recognize sex, at least in part, by color pattern.

The rivalry between two males which were attempting to court the same unmated female in a disputed area between their territories provided an amusing spectacle. The two males, when not fighting, would often chase each other around and about the ever-moving female, flying in a most peculiar manner all the while. Both would fly very slowly and jerkily with a pronounced and continual flopping (up and down motion) of the tail for short distances. The female meanwhile acted as though she were oblivious of all this fuss and attention.

During the courtship period, the males ordinarily sang very little, if at all. Several times, however, a male was observed endeavoring to sing a barely

audible song, but in each case was "severely reprimanded' by the female through the medium of the harsh-sounding warning notes. After six or seven days the courtship period ended almost as abruptly as it began, with the vigorous renewal of songs by the male.

Nests

Locating a suitable nest site as well as the actual building of the first nest takes place during the courtship period. Knight (1908:561) found that the building of the nest was performed solely by the female. Field observations in the present study, too, indicated that the female was entirely responsible for these activities. The building of two nests was closely watched, one at Arlington, Virginia, in 1940 and one at the Patuxent Research Refuge, Maryland, in 1947. In each case, only the female was observed carrying materials to the nest. During these visits the males were not observed to approach the nests nearer than about 20 feet.

The Maryland nest had been barely started when it was first discovered in the evening of May 21. By the end of the following day the body of this nest was fully formed but the lining had not been inserted; on the evening of May 23, the nest appeared to be complete, indicating a nest-building time of about two days. Surprisingly, the first egg was not laid in this nest until May 29, eight days after the start of the nest. The first egg in the Virginia nest was laid three days after the nest had been completed. Conclusions of Knight (1908:561) were considerably at variance with my observations since he reported that this species requires a week to ten days for nest-building.

In total, 23 nests were located in Michigan in 1938. The situations in which the nests were found varied considerably. Most of the nests were found on or near the ground (within three inches) and were supported on all sides by herbaceous plants, usually sedges and grasses of various species. Two nests were found at the base of bushes, braced on all sides by the up-growing limbs, and several were situated on top of marshy hummocks. Almost all were located in damp situations; two nests were just above water with a depth of a half inch or more. Only two nests were placed higher than three inches above the ground; the rim of the highest one of these measured 14½ inches from the ground. This nest, built in tall weeds in late July, may have been placed higher because the undergrowth of vegetation within a foot of the ground was scanty. Nests which were placed above the ground were apparently supported by being merely wedged in between dense shoots and stems of vegetation as no intertwining nesting material could be found around these supporting structures.

Considerable variation was found in the shape and size of the nests, although most of them appeared to be rather bulky compared to the nests of

other warblers. Many were in the form of circular cups while others were found with two sides somewhat compressed. One nest bore a distinct resemblance to the nest of the Oven-bird (*Seiurus aurocapillus*). This nest was on top of a small hummock; it was rather sparsely roofed over with loosely entwined grasses and sedges in such a way as to leave an opening on one side only. Other nests of this type have been reported previously by Audubon (1831:121) and Cook (1893:118). Measurements were made of 12 nests: the outside diameter ranged from 6.8 to 10.8 centimeters (average, 8.5); the outside depth ranged from 6.0 to 12.0 centimeters (average, 8.2). The dried weight of 14 nests collected ranged from 6.7 to 16.8 grams (average, 12.1).

Most of the nests were found, upon dissection, to be composed of three layers or shells, each made up of dry plant remains. The outer shell, which usually comprised most of the bulk and about 70 per cent of the weight, was composed of matted leaves of deciduous trees and shrubs and coarse stems and leaves of many of the larger grasses, sedges, rushes, and cat-tails. The outer shell of any one nest was composed either of a mixture of all or most of these materials or was built predominantly of one type of material. The outer shells of a few nests that were constructed almost entirely of the leaves of narrow-leaved cattail (*Typha angustifolia*) were noticeably smaller and more compact than the others. The middle shell ordinarily comprised about 20 per cent of the weight of the nest and consisted of medium sized leaves and stems of grasses and sedges. One nest was examined in which the middle shell exceeded the outer shell in weight. In this case the outer shell was made up of leaves and coarse stems of weeds, sedges, and grasses while the middle shell was constructed of the matted leaves of deciduous trees and shrubs. The inner shell or lining of most nests comprised about 10 per cent of the weight and consisted of fine grasses and sedges and sometimes a few fine rootlets. Several horse-hairs were also found in the lining of one nest. In a few nests the distinct layering of different types of materials was not evident; instead, there was a gradual diminution in size of materials from the outside to the inside of the nest.

Eggs and Incubation

In the Michigan area, in 1938, the full clutch was determined for 12 nests that had not been parasitized by the Cowbird. Six of these nests contained 4 eggs, 5 contained 5 eggs, and one contained 6 eggs (average, 4.6). The number of eggs laid in first nests seemed to be greater than in succeeding ones. Six of the 12 nests were found in June and of these, one contained 4 eggs, 4 contained 5 eggs, and one contained 6 eggs (average, 5.0). The

other 6 nests were found in July and of these, 5 contained 4 eggs and one contained 5 (average, 4.2).

Records of two nests, one each in Virginia and Maryland, disclosed that after the first egg was laid, one egg was laid on each succeeding day until the full clutch was reached. The time of laying was found to be between 7:00 p.m. and 9:00 a.m. for one egg in the Virginia nest, and between 7:30 p.m. and 8:10 a.m. for one egg in the Maryland nest. The approximate incubation period in both of these nests was about 12 days, or, more specifically, between 11 days, 9½ hours and 12 days, 13½ hours for the Virginia nest and between 11 days, 3 hours and 12 days, 19¾ hours for the Maryland nest. This is in agreement with the observations of Knight (1908:561), Burns (1915:286), and Kendeigh (1945a:159) who also reported the incubation period to be 12 days.

Field observations in the present investigation substantiate the statements by Knight (1908:561) and Chapman (1907:254) that incubation is performed entirely by the female. A total of 17 hours and 50 minutes was spent in a blind recording the incubation schedule of three females in the afternoon. These birds averaged 46, 68, and 70 minutes, respectively, for each setting and 12, 17, and 18 minutes, respectively, for each period spent off the nest (Over-all average of 61 minutes for each setting and 16 minutes for each period off the nest). The longest period that a female spent on the nest at one setting was 84 minutes, and the shortest when undisturbed was 38 minutes. The longest and shortest periods spent off the nest were 26½ and 11 minutes, respectively.

Ordinarily in leaving the nest, when not disturbed, the female hopped to the rim, then to the ground and then by a series of hops made her way through the weeds and sedges for 10 feet or more before flushing. On a few occasions, however, the female flew directly from the nest. Always in approaching the nest she was observed passing through the vegetation close to the ground. Often the male would accompany her to within a few feet of the nest. Upon entering the nest the female almost invariably faced in one direction and then turned and faced in the opposite direction before settling down. While setting on the eggs the female frequently shifted her position and sometimes acted rather restless. Often she would pick at and eat ants or other small insects which were crawling on the rim of the nest or on adjacent vegetation.

Young

The young Yellow-throats normally remain in the nest for eight or nine days after hatching, usually between 196 and 216 hours. During this period they undergo rapid growth and development. The hatching weight is pre-

sumably not much less than the egg weight. Eleven eggs that were weighed were found to range from 1.45 to 1.81 grams (average, 1.66). Several young not more than a few hours old were weighed and the smallest of these weighed 1.80 grams. The weights of five nestlings and certain linear measurements of two nestlings were taken at the end of each day of nest life. The averages of these measurements are shown in Table 1.

TABLE 1

GROWTH OF NESTLING YELLOW-THROATS

	Days of Nest Life							
	1	*2*	*3*	*4*	*5*	*6*	*7*	*8*
Weight (in grams)	2.0	3.2	4.8	6.6	8.1	9.4	10.0	9.8
Total length (mm.)	31.5	35.0	42.2	50.2	58.5	63.2	66.5	70.0
Tarsus (mm.)	6.5	8.6	11.4	13.6	16.1	18.5	20.2	21.7
Culmen (mm.)	3.5	4.6	5.6	6.3	6.9	7.3	7.5	7.7
1st primary (mm.)	.4	.8	2.5	4.3	7.6	11.2	15.2	18.0

The data show that these birds actually quintupled in weight in only six days (from the first to the seventh day). The rapid growth is also indicated by the linear measurements. It is interesting to note that there was a slight loss in weight on the eighth day. Possibly this was due to a reduction in frequency of feeding on the eighth day as the nestlings approach nest-leaving.

The behavior and appearance of the nestlings changed almost as rapidly as their size. The development of the juvenal plumage has been described in a previous report (Stewart, 1952). At the end of the first day the nestlings were truly helpless. Their eyes were closed and they sprawled on their bellies. They did open their mouths in response to sound or touch and occasionally they uttered barely audible *seeps*. At this time the legs and toes were light flesh color with lemon-yellow claws, the bill was light tan with a nearly black egg tooth, the edges of the mouth were cream-colored, and the inside of the mouth was bright peach. By the third day the nestlings were able partly to support themselves on their tarsi. The eyes were opened on the fifth day, the claws were becoming flesh-colored, and the young birds were able to crawl a little by using their legs and wings. On the sixth day they could support themselves readily on their tarsi, and on the seventh they could perch on the rim of the nest. By the eighth day the young were calling *chac-chac-chac*—perhaps these are hunger notes. At this time they were apt to leave the nest upon the slightest provocation. This agreed with the findings of Shaver (1918), who observed that the young left the nest on the eighth day.

Both sexes fed the young. Often only one insect would be brought to the nest at a time, especially if it was large, while at other times the bill of the adult would be crammed with small insects. Occasionally, the adults would

experience difficulty in feeding large insects to the young; in these cases the insects would have to be broken up or partly masticated before the young birds could swallow them. Twice a female was observed attempting to feed large katydids (Tettigoniidae) to the young. She was not successful and finally ate them herself. In an intensive study of one nest, Shaver (1918) found that during the first few days of feeding, the male fed the young much more than the female. This was explained by the fact that the duties of the female in brooding kept her close to the nest during this period. Often food was brought to the nest by the male and delivered to the female who, in turn, apportioned it among the young.

After feeding the young, the adult carefully inspected the nest for droppings. The excreta were either eaten by the parent or carried several yards away and then dropped. They were more commonly eaten during the first few days of nest life and more commonly carried away during the last few days. Shaver (1918) found that the act of feeding furnished the stimulus for the evacuation of excreta which usually occurred shortly after the food was swallowed.

The schedule of feeding was studied at three nests. One nest, containing three eggs and one young, not more than a few hours old, was watched for 2 hours and 32 minutes. During this interval the female fed the young bird seven times (one feeding per 22 minutes). Another nest containing four young about two days old was watched for 3 hours and 53 minutes. These young were fed 17 times during this period (one feeding per 14 minutes). Both the male and female actively participated, the male feeding nine times and the female, eight times; usually two young were fed at each feeding. The third nest containing two young which were about six days old was watched on two consecutive days for a total of 2 hours and 23 minutes. A drop nest trap had been placed over this nest and as a consequence the male did not approach close enough to feed the young. The female did not seem to mind the trap and went directly to the nest without hesitation. During this period she fed the young 26 times (one feeding per 5½ minutes). The data from the last two nests would indicate that the rate of feeding increases with the age of the nestlings through the first seven days of nest-life.

After the young have reached the age of two days, the female apparently does little or no brooding during the daylight hours, although it is probable that this activity is greatly influenced by weather conditions. At the nest containing three eggs and one young not more than a few hours old (see above), the female averaged 17 minutes for each period of brooding and 8 minutes for each period spent off of the nest. On several occasions on hot, sunny days, a female was observed standing on the rim of her nest with wings outspread as if she were attempting to shield the young birds from the

sun. Usually while doing this she would hold her bill open and pant as though suffering from the heat. After dark, the female has been observed to brood the young every night except the last (Shaver, 1918).

Adults were observed to take care of the young for at least two weeks after the young leave the nest. There is some observational evidence that the adult male sometimes assumes more responsibility for the care of the young after they have left the nest than does the female. Possibly, this is because the female often begins to prepare for her next nest without much delay and has little time for attending to the first brood. One interesting observation was made of a fully-grown immature bird approaching an adult female while she was caring for nestlings of her second brood. The female ignored the young bird for awhile and then called to it with a few soft low notes and gently pecked it a few times on the head, whereupon the young bird flew away. Stone (1937:838), while observing the actions of an adult male accompanying a brood of stub-tailed fledglings, noted that the adult, while actively moving about, constantly flirted its tail to one side or the other and nervously flapped its wings, so rapidly as almost to escape detection. This behavior is similar to that displayed by males during inter-territorial encounters or when courting a female.

Nesting Success

Of the 12 breeding females definitely identified in the Geddes Marsh area, 10 (83 per cent) were successful in raising young beyond the nestling stage during the summer. Each female seemingly attempted to raise two broods, but apparently few actually attained this goal. Only one of the Geddes Marsh females was known definitely to have raised two broods beyond the nestling stage.

The number of nests built and number of clutches of eggs laid by a female in a season probably depends to a large extent on the degree of success attending each attempt. In the Geddes Marsh area, three females were known to have built at least three nests each, and four females constructed at least two nests each. The shortest interval known to elapse between the destruction of one nest and attention given by the female to a new nest was somewhat less than 10 days. The interval between the start of two consecutive nests, when the first had been successful was determined in one instance and found to be aproximately 28 days. Consecutive nests built within one territory were placed without any apparent relation to each other.

The histories of 19 nests were followed to their conclusion in the Geddes Marsh area. The eggs of 11 (58 per cent) of these nests hatched, and 7 nests (37 per cent) produced fledgling Yellow-throats. In total, the 19 nests pro-

duced an average of only one fledgling Yellow-throat per nest. However, it must be remembered that most female Yellow-throats build several nests (possibly averaging about three) during the season, thus accounting for the maintenance of the population level.

The heavy parasitism by the Cowbird is an important factor in connection with the high mortality rate of the eggs and young. Of 22 nests found in Michigan in 1938 containing eggs or young, 10 (45 per cent) had been parasitized by the Cowbird. In these 10 nests the number of Cowbird eggs or young ranged from one to three (average, 1.8 per nest). In the Geddes Marsh area, nine nests had been parasitized by the Cowbird and of these only one produced a fledgling Yellow-throat. On the other hand, ten nests in the Geddes Marsh area had not been parasitized and of these six produced fledgling Yellow-throats. The average number of fledgling Yellow-throats produced per nest parasitized by the Cowbird was only .1, while the average number produced per non-parasitized nest was 1.9. The average number of Cowbirds fledged in the parasitized nests was .4 per nest.

The causes for the destruction or disappearance of many of the eggs and young were not ascertained. Several of the nest were found greatly disheveled, indicating that some predatory animal may have been responsible. Other nests were found intact and thus furnished no clue as to what the marauders might have been. Two nests had been badly smashed as if some large mammal had stepped on them. Another nest was over-run with a mass of small ants. One nest containing four young gradually became tilted to one side, eventually causing one of the nestlings to fall out.

Summary

Investigations concerning the life history of the Yellow-throat were made in southern Michigan during the spring and summer of 1938. Supplementary information was also obtained at Arlington, Virginia, in 1940 and at the Patuxent Research Refuge, Maryland, in 1947.

Resident males established territories almost immediately upon arrival in spring. In southern Michigan some resident males arrived at least as soon as, if not before, transient males. Most females appeared on their nesting ground about a week later. Adults were engaged in nesting activities from the time of their arrival in spring until the advent of the post-nuptial molt in late summer.

Typical Yellow-throat habitat consists of a mixture of a dense herbaceous vegetation and small woody plants in damp or wet situations.

At Ann Arbor, the Yellow-throat was a common breeding species in its restricted suitable habitat. The population density in one area of suitable habitat was about 69 territorial males per 100 acres. Of 11 territorial males

that were intensively studied, one was polygamous (with two mates), nine were monogamous, and one was probably monogamous (with at least one mate).

The song of the individual Yellow-throat was heard throughout the breeding season except for the courtship period. Two major types of song were the common song given while perched, and an occasional, more elaborate, flight song. Most males sing in spurts, singing at fairly regular intervals for a considerable period and then abruptly ceasing for another period. The vocabulary of both sexes included several types of call notes that appeared either to have special functions or to represent outward expressions of distinct emotional states of the bird.

Resident males were antagonistic toward each other throughout the breeding season. Most remained on well-established territories during this period. Territories of 10 monogamous males ranged in size from .8 to 1.8 acres but the territory of one polygamous male occupied 3.4 acres. The behavior of males during inter-territorial encounters was similar in some respects to their behavior when courting females.

While courting females, the males are very attentive and seldom sing for about one week. During the courtship period the female locates the nesting site and builds the nest without assistance from the male.

Nests, constructed of dried plant materials, were situated on or near the ground and were supported on all sides by stems of herbaceous plants or limbs of shrubs. Many nests were composed of three layers with the coarser materials being used in the outer layer.

The full clutch of eggs in 12 nests ranged from 4 to 6 (average, 4.6). Early clutches seem to be larger than later ones. After the first egg is laid, one is laid on each succeeding day until the clutch is complete. Incubation period is about 12 days. Incubation is only by the female. Records of daytime incubation schedules of three females about half way through incubation indicate that the periods spent on and off the nests average about 61 and 16 minutes, respectively.

Young Yellow-throats usually remain in the nest for eight or nine days. During this period they grow and develop rapidly. Their weight quintuples in six days. Both sexes are active in feeding the young and in removing excreta from the nest. Records of feeding at three nests showed a range of one feeding per 5½ minutes to one feeding per 22 minutes, the rate increasing with age of young. Adults care for the young for at least two weeks after the young leave the nest.

Ten of 12 females that were intensively studied were successful in raising young beyond the nestling stage. Only one of these raised two broods, although three females built at least three nests each. In 19 nests, 11 (58 per

cent) produced nestlings and 7 (37 per cent) produced fledglings. In total, the 19 nests produced an average of one fledgling Yellow-throat per nest. Of 22 nests that were found near Ann Arbor, 10 (45 per cent) had been parasitized by Cowbirds. Nine of the ten parasitized nests produced an average of .1 fledgling Yellow-throat per nest, and ten nests that had not been parasitized produced an average of 1.9 Yellow-throats per nest.

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Patuxent Research Refuge, U. S. Fish and Wildlife Service, Laurel, Maryland, June 20, 1952

GENERAL NOTES

A Michigan record of the Black Rail.—On 12 September, 1951, I collected a Black Rail (*Laterallus jamaicensis pygmaeus*) at Portage Lake, Section 31, Waterloo Township, Jackson County, Michigan. The bird flushed from tall grass and sedge at a distance of about seven feet. The ground surface was dry and about 18 inches above the level of the nearby Portage River. The specimen (Museum of Zoology No. 119,882) was an immature female with the ovary measuring 8 × 3 mm. and the skull incompletely ossified. The bird, weighing 36.33 grams, was very fat. The colors of the soft parts were: feet, dull purplish-black; bill, black; iris, pale ochre-brown. This is the Black Rail referred to in the *Jack-Pine Warbler* (30, 1952:9); it is the first specimen of the Black Rail taken in Michigan.—Robert S. Butsch, *University Museums, University of Michigan, Ann Arbor, October 20, 1952.*

Great Blue Heron feeding on a muskrat.—On August 11, 1952, I observed a Great Blue Heron (*Ardea herodias*) that was standing in a small pothole between the village of Baltic and Portage Lake, in Houghton County, Michigan (section 24, T 54N, R 34W). In its mandibles the heron was holding a full grown muskrat (*Ondatra zibethicus*) by the head. From the soggy appearance of the fur, I judged the muskrat had been dead for some time. The heron dropped and picked up the muskrat several times before leaving it near the edge of the pond and flying away. During this time I was sitting in my car in plain sight of the heron which was obviously disturbed by my presence. Cursory examination of the literature does not reveal any record of a Great Blue Heron feeding or attempting to feed on a muskrat although it has been noted feeding on pocket gophers.—Arthur Ward Peterson, *Game Division, Department of Conservation, Lansing, Michigan, September 17, 1952.*

Unusual behavior of an Osprey.—On October 4, 1952, A. C. Berkowitz and I were attracted by a large whitish bird soaring over a field and occasionally hovering in the manner of the American Rough-legged Hawk, *Buteo lagopus*. We immediately recognized the bird as an Osprey, *Pandion haliaetus*. While we were watching this performance a Marsh Hawk, *Circus cyaneus*, arrived and seemingly tried to drive the Osprey away.

The Osprey flew to a tree in the same field and perched on a bare limb, affording us the opportunity of examining it through a 20 × telescope at a range of 150 yards. After a few minutes in the tree, the bird again took to the air, coursing back and forth, occasionally hovering, and two or three times dropping to the ground or within inches of it. No prey was seized, apparently. The bird finally alighted on the ground and was there when we left.

The field in question is about one-half mile from the Raccoon River and one and one-half miles from the Des Moines Waterworks Impounding Reservoir near Des Moines, Iowa. Ospreys are often observed fishing in the reservoir. Most writers state that the food of Ospreys is exclusively fish, a few mention water snakes and salamanders, and one or two cite instances of poultry being taken, but I am unable to find anything in the literature to indicate that Ospreys have been previously seen hunting in the manner observed by us.—Woodward H. Brown, *4815 Ingersoll Avenue, Des Moines, Iowa, October 9, 1952.*

Wood Pewee builds with green leaves.—In May, 1951, at Nashville, Tennessee, I observed a Wood Pewee (*Contopus virens*) building a nest on a horizontal fork of a hackberry tree at a point about 25 feet from the ground and 12 feet from the trunk. The nest was level with, and about 15 feet away from, a second story window of a house so that details could easily be observed through binoculars.

At 4:30 a.m., May 19, 1951, I began careful observation. The builder, presumably the female since the mate sang at intervals nearby, brought materials at the rate of three or four trips a quarter-hour. She worked from a sitting position inside the partially constructed nest for one-half to one minute at a time. Soon she made a short flight to an elm, returned immediately and deposited a *green* leaf on the outside top rim of the nest. The leaf adhered fairly securely and during subsequent visits to the nest the bird worked her bill and chin over the leaf, shaping it to the contour of the nest. The green color of the fresh leaf was distinct against the gray of the nest. The bird continued to build but did not bring more green leaves. During the latter part of the observation period she shaped fine, branched straws into the inside of the shallow, cup-like structure.

At 6:50 a.m., a Blue Jay (*Cyanocitta cristata*) appeared at the nest, looked it over inside and out, then began to peck and pull the nest apart. The material held together as if caught in an elastic matrix, but the jay pulled until the nest was dislodged from its foundation. The adherent materials, attached at only one point to the limb, hung from it like a bedraggled streamer.

By late afternoon the nest had fallen to the ground. I was surprised to find a chief portion of the body of the nest composed of *green* leaves. All the materials clung together shapelessly but general relationships were recognizable. The lining was incomplete; the outside covering appeared to be started only at the base; the central lamination or body of the nest seemed to be essentially complete. Upon separation six types of materials appeared: (1) fine branched seed plumes of grass; (2) coarser weed straws; (3) small strips of shredded bark and one or two small pieces of hard bark; (4) bits of lichen; (5) green leaves; and (6) web silk. The straws, bark, and lichen could be separated from the web but the green leaves and the silk were inseparable and established a felt-like consistency within the wall of the nest. The seed plumes were probably all from blue grass. They formed the incomplete lining. The few coarser stems outlined the foundation. The lichen was fixed on the outside, largely at the base where the nest was attached to the limb. Most of the green leaves were those of elm. Other green material included two complete leaves of white clover, two grass blades, a grass stem, and one or two leaves—probably hackberry. Green leaves comprised about a third of the material of the uncompleted nest. The fine downy-pubescense of the elm leaves seemed to afford a particularly good surface for the adherence of the spider web.

The only other observation I have made on the inclusion of green leaves in nest material by a Wood Pewee was exactly a year earlier. I saw a pewee carry a green leaf to a 1950 nest located about 20 feet from the 1951 nest. Only one deposition of a green leaf was observed, but detailed observations were not made. The green faded and was covered over as building continued.

Bent (1942. *U. S. Natl. Mus. Bull.*, 179:269) quotes Bendire's description of "a single well-preserved apple leaf" lying "perfectly flat and exactly in the center and bottom" of a well preserved Wood Pewee's nest. No mention of green leaves or other dried leaves is made. Of other flycatchers, Bent (*op. cit.*: 72, 138, 255–256, 262, 305) cites five which use dried leaves as building material.

Among species which commonly use green leaves in their nests are the Mississippi Kite (*Ictinia misisippiensis*), Red-tailed (*Buteo jamaicensis*), Red-shouldered (*Buteo*

lineatus), Swainson's (*Buteo swainsoni*), and Broad-winged (*Buteo platypterus*) hawks, the Purple Martin (*Progne subis*), and the Starling (*Sturnus vulgaris*). The hawks (Bent, 1937. *U. S. Natl. Mus. Bull.*, 167:65, 151, 185–186, 223, 240) variously use green leaves as lining material, around the rim, or in the nest with the young. Purple Martins (Allen and Nice, 1952. *Amer. Midl. Nat.*, 47:622) often line a nest with green leaves and may continue depositing green leaves during egg-laying and incubation. Starlings (Kalmbach and Gabrielson, 1921. *U. S. Dept. Agri. Bull.*, 868:10; Laskey, personal communication) may use green leaves dispersed throughout the nest or as lining, or they may deposit them in a nest cavity before the nest is begun.—KATHERINE A. GOODPASTURE, *408 Fairfax Avenue, Nashville, Tennessee, January 13, 1952.*

Notes on some songs of a Pine-woods Sparrow.—In April, 1950, in southwestern Georgia, we recorded on magnetic sound tape the recital of a Pine-woods Sparrow (*Aimophila aestivalis*) who displayed considerable variety in his songs. The bird occupied a portion of a three-acre tung grove which was surrounded mainly by pine forest. He appeared to have several singing stations; one was in a tung tree near the edge of the grove, and there we placed our microphone while we sat by the recorder, some 300 feet away. The bird's activities were as variable as his songs; he did not consistently use the same twig in our tree as a song-perch. Sometimes he sang only three or four times before flitting away; sometimes he sang a dozen or more times. Each song lasted about 2½ seconds, with about 12 seconds' pause between songs. We recorded on several successive mornings, between 6:30 and 8 a.m. for a total of about 15 minutes' singing time, although much of the recording was marred in various ways.

In general structure, the songs usually consisted of a single long note, followed by five to nine notes uttered rapidly—almost a trill, the two parts of the songs being about equal in length. Rarely, the long opening note was omitted entirely. Our bird displayed surprising ability to produce different "song types" or "song patterns" each of which, however, mantained the major characteristics of the "family theme"; that is, every song could be recognized easily as belonging to a Pine-woods Sparrow. Although variations in the structure of the song were noted, his principal changes in the species song pattern were in the pitch of the two parts of the songs. The opening note sometimes was higher in pitch, occasionally of the same pitch, and sometimes of lower pitch than the second part. Sometimes the pitch of one portion of the song would differ but slightly from the pitch of the same portion of a preceding song. Usually the pitch of the opening note remained uniform; more rarely, the pitch of the opening note would change slightly; occasionally, this type of pitch change was displayed also in the second part of the song. The major changes in the structure of the songs usually occurred in the second part of the song, these including variations in the number of notes and their tempo; there was occasionally an apparent slurring or gliding in pitch, giving the impression of double notes.

In the great majority of our recordings, this bird repeated each song pattern twice before changing to another pattern. Occasionally he gave a song pattern only once, then changed to another pattern; more rarely, he gave a song pattern three times before changing to another pattern.

In clarity and sweetness, the recital was similar to that of the Field Sparrow (*Spizella pusilla*); however, the individual Field Sparrow usually confines himself to just one particular variation of his family "song pattern," whereas this Pine-woods Sparrow, in comparison, seemed capable of producing an almost endless variety of patterns.—JERRY AND NORMA STILLWELL, *R.F.D. 2, Fayetteville, Arkansas, August 2, 1952.*

Black Vulture breeding in Pennsylvania.—Black Vultures, *Coragyps atratus*, have been seen occasionally in various parts of Pennsylvania for many years. Warren (1888. "Report on the birds of Pennsylvania," Harrisburg, p. 237) listed the species as a rare straggler in the state. Beck (1924. "A chapter on the ornithology of Lancaster County, Pennsylvania," New York, p. 18) reported sight records in Lancaster County and listed this vulture as a "summer visitant." Townsend (*in* Bent, 1937. *U. S. Natl. Mus. Bull.*, 167:43–44) cited numerous records of the species farther north, and Hope (1949. *Auk*, 66:81–82) reported the first Black Vulture collected in Ontario. There are, however, no published breeding records for Pennsylvania.

Since the fall of 1949, I have observed from time to time as many as 12 Black Vultures among a large flock of Turkey Vultures, *Cathartes aura*, which roost at Big Round Top on the Gettysburg National Military Park, Gettysburg, Adams County, Pennsylvania. Most sightings have been in late fall, winter, and early spring. Few Black Vultures have been seen later than March 25. At approximately that date the vulture population at the Big Round Top roost is noticeably reduced and I assume that the birds, at least some of them, spend their nights at or near their breeding territories. The summer disappearance of the Black Vultures at the roost and the rare observations at scattered points about Adams County, led me to suspect that the species had become a permanent and breeding resident of this area.

Accordingly, I attempted to find a nest of a Black Vulture. In the spring of 1951 the search was unsuccessful. On April 20, 1952, I flushed a Black Vulture from a small cave on a rocky mound approximately six miles south-southwest of Gettysburg. There was a small depression in some dried leaves in the cave but no other evidence of nesting. I returned on April 22 and again flushed the vulture from the cave. This time the depression contained one egg.

Four weeks later the nest was again empty. Fox scats were abundant in the vicinity and the vulture egg may have fallen prey to foxes.

Stewart and Robbins (1947. *Auk*, 64:268) list a nest found near Bowie, Maryland, as "probably near the northern limit of the breeding range of the species." The nest near Gettysburg, Pennsylvania, would extend the known breeding range of the Black Vulture some 60 miles farther north and establishes a first breeding record for the state.—G. E. GRUBE, *Biology Department, Gettysburg College, Gettysburg, Penn., August 23, 1952.*

An extended incubation period of the Ruffed Grouse.—On June 6, 1952, at the Cusino Experimental Deer Enclosure at Shingleton, Michigan, a Ruffed Grouse (*Bonasa umbellus*) was flushed from a nest containing eleven eggs. The following day a foot-high fence of half-inch poultry screen was placed to enclose an area 20 feet in diameter around the nest in order to detain the chicks after hatching. The nest was inspected daily previous to the supposed hatching period, twice daily during the possible hatching period, and once daily thereafter. On June 23 and June 27, the bird was not observed on the nest, but the eggs were still warm. On July 20, one Ruffed Grouse was flushed from within the enclosure and another was flushed from the nest. On some occasions the hen was flushed from the nest so that the eggs could be examined, but usually the bird was not molested. On August 14, the grouse was not observed on the nest, and the eggs were cold. The eggs remained cold on the two following days. If we assume June 6 as the beginning of incubation (no eggs were laid after that date) and August 14 as the last date of active incubation, they incubated for 70 days. Normal incubation is about 24 days. The eggs were examined and found to be infertile.—TONY J. PETERLE, *Cusino Wildlife Experiment Station, Michigan Department of Conservation, Shingleton, Michigan, August 26, 1952.*

EDITORIAL

Dr. Arthur A. Allen will retire from his position as Professor of Ornithology at Cornell University in late August. In 45 years on the Cornell faculty Dr. Allen has worked with more than 10,000 students. His influence on these students, though difficult to measure, constitutes a great contribution to ornithology. Dr. Allen is widely known for his several books, technical papers, bird photographs, and sound recordings. Although retiring from formal teaching, Dr. Allen will continue his other ornithological pursuits.

Dr. Ernest Mayr, Curator of the Whitney-Rothschild Collection, American Museum of Natural History, has been appointed Alexander Agassiz Professor of Zoology in the Museum of Comparative Zoology, Harvard University. Mr. James C. Greenway, Jr., has been appointed Curator of Birds in the Museum, succeeding the late James L. Peters, and Mr. Raymond A. Paynter, Jr., has been appointed Assistant Curator of Birds.

Dr. Ira N. Gabrielson, president of the Wildlife Management Institute and former Director of the U. S. Fish and Wildlife Service, recently became the third recipient of the Aldo Leopold Memorial Award, conservation's highest honor, for his accomplishments in wildlife administration and in prevention of exploitation of our natural resources.

Volume 88, covering the literature of 1951, of the Aves section of the *Zoological Record* was published in April and is now available from the Secretary, Zoological Society of London, Regent's Park, London, N. W. 1 (price 7s. 6d. plus 4d. postage). Lt.-Col. W. P. C. Tenison, compiler of the Aves section, deserves the gratitude of all ornithologists for performing this essential service so capably. Again we urge Wilson Club members to support the Zoological Society through purchase of the Aves section of the *Zoological Record*.

THE WILSON ORNITHOLOGICAL CLUB LIBRARY

The following gifts have been recently received. From:

Holly Reed Bennett—8 books, 23 magazines, 32 pamphlets
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George J. Wallace—1 book
Merrill Wood—1 reprint

ORNITHOLOGICAL LITERATURE

NATURAL COMMUNITIES. By Lee R. Dice. University of Michigan Press, Ann Arbor, 1952:6½×10 in., xii+547 pp., 52 figs. $5.50.

Ecology has been defined as the science of communities and Dice's new book on natural communities does indeed cover the field of ecology. The author may be credited with rendering a great service. The book is eminently suitable as a text for an ecology class of university level, filling a need that has long existed, and it is an indispensable reference for anyone interested in ecology. The 23 chapters include: community ecology; some important kinds of communities; methods of describing and measuring communities; methods for the estimation of populations; physical factors of habitats that affect communities; effects on communities of fluctuations in the physical conditions of their habitats; food relations within communities; fluctuations in populations; fluctuations in community composition; relations of organisms to their ecosystems; home ranges and territories; effects of social behavior on the community; ecologic relations between species; community equilibrium; effects of communities on their physical habitats; ecologic succession; local and geographic variation within communities; relations between communities; classification of associations and microassociations; larger units of community classification; communities of the past; evolution of communities; philosophy of communities.

An impressive amount of material has been digested, organized and concisely set forth in thoroughly readable and understandable language. Unlike some of his forerunners and contemporaries, the author does not find it necessary to coin new terms in profusion, nor does he use many of the technical ecological terms that have been proposed by previous authors. He has the faculty of presenting ecological concepts simply and clearly in everyday language that should be understandable to the average biology student. Those technical terms that are unavoidable are defined and illustrated with appropriate examples.

Various terms are used with meanings or connotations slightly different from those that have been customarily associated with them in earlier works. One term which is used frequently throughout the book is the "stand." In the past, as the author states, this term has been applied mostly to examples of various kinds of forests, but he uses it here in a broader sense. "A stand may be defined as a local example of an association composed of those individual plants and animals that live together in a particular situation (Braun-Blanquet, Fuller, and Conard, 1932:23)." "Each stand is an actual concrete community which exists at a given time and covers a particular area." It is stated to be the most important unit of ecologic classification, but applies "only to a community of considerable importance that covers an appreciable area. A grove of trees together with its associated plants and animals, for example, is a stand. On the contrary, a single tree or clump of plants is not usually called a stand. A "microstand" is defined as a minor concrete community, such as the assemblage of plants and animals that live in and upon a decaying log. On page 392, in discussing mixed stands, the author mentions both Douglas spruce and Douglas fir. It will not be apparent to readers unfamiliar with the species that these are one and the same.

Symbiosis, used in an especially broad sense, is defined as the living together of individual organisms of dissimilar species. "Most of the plants and animals of a given stand, for example, live in disjunctive symbiosis with one another." Two main types of symbiosis are: conjunctive, involving close bodily contact between the two symbiotic

organisms; and disjunctive, in which the associated organisms are free-living. The term includes both parasitism and mutually beneficial symbiosis. The term commensalism is not mentioned in this discussion of symbiosis, although the word commensal does appear just once, on the final page (320) of this chapter, "Ecologic Relations between Species."

In Chapter 20, "Larger Units of Community Classification," four separate systems are each briefly discussed: (1) Community Type, (2) Life Zone, (3) Biome, and (4) Biotic Province. Quite understandably the author devotes more space to the system of biotic provinces, developed by himself, than to the other three combined. Even so, the treatment is cursory and nothing new is added to the material already presented in the author's "The Biotic Provinces of North America" published in 1943. It seems regrettable that the biotic provinces, potentially useful in study of animal distribution and ecology, have not been further described or classified in the last ten years as the original attempt was admittedly a tentative outline based on incomplete information. Throughout the present book the author refers to geographic areas by the names of their respective biotic provinces, the Hudsonian, Californian, Chihuahuan, etc. A map of the 28 biotic provinces of North America is reproduced from the author's earlier book on this subject. On page 447 it is stated: "The Chihuahuan biotic province in southeastern Arizona, for example, is divided into the Santa Catalina, Chiricahua, Huachuca, and Santa Rita biotic districts (Dice and Blossom, 1937)." However, this statement is not in agreement with the map on page 444 which shows the Chihuahuan entering the United States only in western Texas and southern New Mexico, with its western boundary considerably to the east of the Arizona border; the area in question would fall entirely within the Apachian biotic province.

In comparing the usefulness of the several systems Dice states, "Biomes and biotic provinces are not necessarily to be considered as mutually exclusive and competing systems of ecologic classification, but rather as more or less supplementary to each other." However, he regards life zones as of little value for the classification of communities, and states that the community-type system is of value for description only, not classification.

In the preface, the author states that no attempt is made to supply a complete bibliography of community ecology and this statement is reiterated at the beginning of the "Literature Cited" section. Nevertheless, more than 1100 titles are included, and they cover the field thoroughly. The latest publications included are those of 1949. Relatively recent publications, of the past ten years, make up a susbstantial proportion of the total, reflecting the rapid recent progress in development of ecology. A small proportion of important early works, from the nineteenth century and the early part of the present century, are also included. The works of British and European authors are prominent in the bibliography. Especially noteworthy is the inclusion of a large number of titles by Russian authors, and the content of these papers is often mentioned in the text, providing insight as to the extent and trends of ecological research in Russia.

Of the more than 1100 papers cited, over 200 are concerned primarily with birds, and a somewhat larger number deal primarily with mammals. Although the author has been mainly concerned with mammals and birds in his earlier publications he is not preoccupied with these groups to the extent of neglecting smaller and less conspicuous animals that may be equally important elements of natural communities. Insects and other invertebrates figure prominently among the animals mentioned in discussing various phases of community ecology. Chapter 11 on "Home Ranges and Territories" may be of particular interest to the ornithologist, since much of it is concerned with birds, the most typically territorial animals. Representatives of many other groups are, however,

duly discussed in this connection. The distinction between territories, which are defended, and home ranges, which are not defended, is emphasized, and the many different types of territories are described and illustrated in an excellent short summary of this subject.

On the average there are several citations to the literature on each page of the text, but the author rarely uses direct quotations; he has extracted the essential material from pertinent literature and integrated it into the text in his own wording to attain greater continuity, smoothness, and clarity. At the end of each chapter is a short list of, usually, three to ten "selected references."

The illustrations are not numerous (52 in all). Figure 2, showing "A simple ecologic community composed of a single rabbit sitting under a single blackberry bush," perhaps might have been dispensed with. On the whole the illustrations are well chosen to emphasize or amplify with diagrammatic simplicity some of the more important concepts discussed in the text. Most of the illustrations are reproduced from other publications, but a number are from originals by C. W. Angell, including several pencil sketches of communities in the arid southwestern United States.—HENRY S. FITCH.

STALKING BIRDS WITH COLOR CAMERA. By Arthur A. Allen. Edited by Gilbert Grosvenor. National Geographic Society, Washington, D.C., 1951:7×10 in., 328 pp., 331 unnumbered, color photographs (264 by the author), 87 black and white photographs, 2 wash drawings (W. A. Weber), 3 maps. $7.50.

This beautiful collection of very well reproduced color photographs will stand as an appropriate monument to Dr. Allen's eminence in the field of bird photography. There are today many fine bird photographers, a few of them perhaps as skilled as Dr. Allen, who, however, was taking excellent pictures of birds when most present competitors were in knee-breeches, and before some were born. The author and editor have not hesitated to draw upon the work of others to illustrate the various phases of ornithology and photography touched upon in this book, but the slight degree to which this has been necessary is evidence of Dr. Allen's breadth of experience and the extensiveness of his travels.

It is difficult to single out particular photographs from this impressive array. However, some seem to demand individual mention, among them the Golden-winged Warbler (p. 58), Indigo Bunting (p. 92), Tree Sparrow (p. 110), Marsh Hawk (p. 189), Western Gulls (p. 255), Bald Eagle (p. 180), Duck Hawk (p. 192), and Woodcock (p. 232). Without wishing to revive the senseless controversy of art versus photography, this reviewer thinks that the pictures cited strongly resemble fine paintings, embodying that combined perfection of composition, subjugation and elimination of detail, beauty of tone, and grace of pose which are the objectives of photographer and painter alike, and which are inevitably more difficult for photographer than for painter to arrange and control.

Most of the photographs and text chapters of this book have been published previously in the *National Geographic*. Otherwise the cost would have been prohibitive. The frequent sub-headings of the text and the captions of the many illustrations are couched in somewhat slangy language which may ruffle the feelings of a few scientific ornithologists. It must be borne in mind, however, that the *National Geographic Magazine* has remained successful for many years by the use of these methods, and that Dr. Allen, as well, has succeeded in this way in capturing the interest of thousands of people who are not, and will never be, ornithologists. Aimed at similar audiences, this effort should do equally well.

Being largely a gathering of independent articles, the chatty, readable text covers a diverse quantity of ornithological subjects, including bird photography, use of stroboscopic

light, bird migration, behavior, senses, and bird protection, as well as narratives of some of the author's many trips to Labrador, Alaska, Mexico, and other places. Ardent students of behavior will no doubt regard some of the discussions of this subject as greatly over-simplified, yet the author is to be thanked for a readable indication, to a wide field of lay readers, that animal activity is to be judged by other than human standards.

The book is heartily recommended to all readers, whether lay or scientific, who have a real appreciation of the beauty of birds.—ROBERT M. MENGEL.

CONTROVERSIAL CONSERVATION

A contribution from the Wilson Ornithological Club Conservation Committee

Man always has depended upon the bounties of nature for his sustenance and it is unreasonable to expect him to stop eating—and die himself—rather than take the life of some other animal. Neither can we expect man to freeze rather than destroy a tree for the purpose of making shelter for himself and his family. These facts are self-evident. Formerly, the slaying of deer and the cutting of trees was done by the individual who used these products of nature to satisfy his own wants. Today, we purchase our meat from a butcher shop and secure our lumber from a building supply store, and it is seldom that we harvest directly nature's product. For this reason the conservation of our natural resources may be only of academic consideration to a large part of the American people. Twentieth century Americans may deplore the over-grazing of western grass lands, but insist upon meat in their daily menu.

Theodore Roosevelt is often credited with placing the term "conservation" upon the lips of the American public. For the past half-century the word has been used over and over again until today almost everyone is "for" conservation just as they are "agin" sin. The theological term "sin" has many meanings to different individuals and it appears that the term "conservation" may have as many definitions.

Those of us in the conservation field probably differ as much in our interpretation of the term as does the general public. Most naturalists agree with Thoreau that "Every creature is better alive than dead, men and moose and pine-trees, and he who understands it aright will rather preserve its life than destroy it." It is equally true, however, that most professional naturalists would consider themselves remiss if they did not personally destroy a mortally wounded or sick animal rather than let it die a painful and lingering death. How can a conservationist kill and protect at the same time? Can a hunter and a bird watcher both be called "conservationists"? How can we reconcile the different approaches of the National Park Service, where no life—neither plant nor animal—may be taken and the U. S. Forest Service where the cutting of timber is a standard management practice and the harvesting of the surplus game is considered logical? Again, why does the Fish and Wildlife Service purchase and develop wildlife refuges where waterfowl are encouraged to nest and rear their young without hindrance and, within the same agency, promulgate and enforce regulations for the hunting of ducks and geese? State wildlife agencies devote a majority of their attention to the removal of wild game by sportsmen during the fall and, at the same time, prosecute anyone who kills wild animals at other seasons of the year. All of these agencies consider themselves conservation organizations dedicated to the preservation of our various natural resources. Most individuals would agree that such divergent activities of these organizations actually are dedicated to the conservation of our natural resources only if they have an acceptable and mutually agreeable understanding of

the meaning of conservation. According to the dictionary, conserve means "to maintain in continued being" and conservation, as we use it, includes "a preserving, guarding, or protecting; a keeping in a safe and entire state; preservation." There are those of us who would like to add to these definitions "use without abuse and/or destruction."

The forester holds that his axe is the best tool for the conservation of the forest; we would agree with him if we accept the fact that the cutting of the timber is the only way we can devote the trees to human use and still "maintain them in continued being." True, ecological succession would gradually replace the same species of trees over a long period of time if the old monarchs of the forest were permitted to rot, fall, and decay. The forester bases his conservation activities on the premise that it is better to cut and utilize mature trees rather than to let them be wasted by rotting. He maintains that he is preserving by utilization; that he is conserving and guarding his forest by means of his axe.

Many naturalists think that any form of hunting is destructive and therefore does not fall in the category of conservation by any stretch of the imagination. On the other hand, most state and federal wildlife agencies take the opposite view. They hold that the gun is a tool that will permit the removal and use of surplus game and that they can best guard and preserve our wildlife resources by such judicious utilization. Our federal and state parks, on the other hand, permit neither gun nor axe to be used except under extremely unusual circumstances. Are they both right?

Within the natural sciences, it seems that we must accept the fact that man by his activities has changed the face of this earth and that we must accept him, his desires, his needs and his demands in our conservation activities. Bird protection—especially of our songbirds—should include the complete prohibition of the taking by man of any species which is or will be endangered by such removal. This is the only way to conserve certain species. On the other hand, many of our game birds have been harvested annually without detriment to the species. Would it be true conservation to prohibit the taking of all birds because such regulations are necessary to preserve certain species? Would it be medically sound to remove the appendix of every person—man, woman, and child—because it has been established that appendectomies have saved the lives of scores of persons? The logic is identical and the answer obvious.

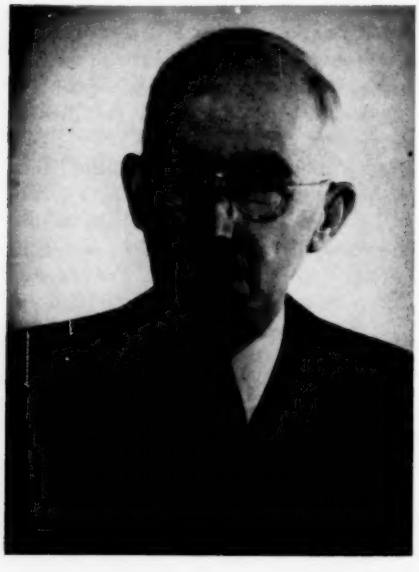
Most of our parks today are having great difficulty in "preserving and guarding" their natural resources due to excessive human use of these areas (*cf.* Gunn and Mosby, 1952. *Wilson Bull.*, 64:57–60). State and national parks were established, primarily, so that man could see and enjoy nature; but man, by his excessive numbers, is often destroying the beauty which the park officials are endeavoring to preserve for him. Protection of the deer in many states has resulted in heavy destruction of the fodder vegetation and the starvation of thousands of animals. Both of these situations employ the complete protection of nature from direct utilization by man. In both instances the objective is to conserve the natural resources.

We must be logical and reasonable in our definition and in our practice of conservation. We must establish a more workable understanding between the various factions in the conservation field. There are many types of sin and it is possible that there are many types of conservation. It is possible for us to sin in our fight against evil; it is possible that we may destroy a natural resource in our efforts to conserve it. It has been stated that conservation is a point of view, not an assemblage of facts. Perhaps those of us interested in conservation will have to broaden our point of view to assure that we do not destroy in our over-zealous efforts to conserve; that we do not abuse by use; that we perpetuate while we utilize.—HENRY S. MOSBY AND W. W. H. GUNN.

NEW LIFE MEMBERS

Don Bleitz was born in Los Angeles, California, October 1, 1915. Although he received his academic degree in engineering, his interest in natural history made itself apparent early in his life. Beginning with collecting butterflies, he soon shifted to bird study and especially bird photography. His exceptional photographs have appeared in many national publications. A growing collection of photographs of western birds and field notes led him to conceive the idea of producing a book on the birds of western United States, in which a very large number of his color photographs would be included. He and his wife, who shares his interest in birds, have been engaged in the preparation of the book for two years.

Don designs and manufactures much of his photographic equipment which includes special long-focus lenses and completely radio-operated cameras. In business life he operates a photographic manufacturing firm and pharmaceutical manufacturing businesses.



Tracy I. Storer was born in San Francisco in 1889 and lived in the Bay Region through graduation from the University of California in 1912 and as a staff member of the Museum of Vertebrate Zoology until 1923. While at the Berkeley campus he taught various courses, including ornithology and vertebrate natural history, and was co-author of "The Game Birds of California" and "Animal Life in the Yosemite." Subsequent to 1923 he has been on the Davis campus of the university, and until 1951, was in charge of zoology, teaching a varied program from general zoology to economic vertebrate zoology, and giving special attention to economic relations of birds and mammals. His well known text, "General Zoology," and "Laboratory Manual of General Zoology" grew out of long participation in teaching the beginning course. The study of birds has been a lifelong interest, both professional and avocational.

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SUGGESTIONS TO AUTHORS

Manuscripts intended for publication in *The Wilson Bulletin* should be neatly typewritten, double-spaced, and on one side only of good quality white paper. Tables should be typed on separate sheets. Before preparing these, carefully consider whether the material is best presented in tabular form. Where the value of quantitative data can be enhanced by use of appropriate statistical methods, these should be used. Follow the A. O. U. Check-List (fourth edition) and supplements thereto insofar as scientific names of United States and Canadian birds are concerned unless a satisfactory explanation is offered for doing otherwise. Use species names (binomials) unless specimens have actually been handled and subspecifically identified. Summaries of major papers should be brief but quotable. Where fewer than five papers are cited, the citations may be included in the text. All citations in "General Notes" should be included in the text. Follow carefully the style used in this issue in listing the literature cited. Photographs for illustrations should be sharp, have good contrast, and be on glossy paper. Submit prints unmounted and attach to each a brief but adequate legend. Do not write heavily on the backs of photographs. Diagrams and line drawings should be in black ink and their lettering large enough to permit reduction. The Illustrations Committee will prepare drawings, following authors' directions, at a charge of $1 an hour, the money to go into the color-plate fund. Authors are requested to return proof promptly. Extensive alterations in copy after the type has been set must be charged to the author.

A WORD TO MEMBERS

The Wilson Bulletin is not as large as we want it to be. It will become larger as funds for publication increase. The Club loses money, and the size of the *Bulletin* is cut down accordingly, each time a member fails to pay dues and is put on the 'suspended list.' Postage is used in notifying the publisher of this suspension. More postage is used in notifying the member and urging him to pay his dues. When he does finally pay he must be reinstated on the mailing list and there is a publisher's charge for this service. The *Bulletin* will become larger if members will make a point of paying their dues promptly.

NOTICE OF CHANGE OF ADDRESS

If your address changes, notify the Club immediately. Send your complete new address to the Treasurer, Leonard C. Brecher, 1900 Spring Drive, Louisville 5, Kentucky. He in turn will notify the publisher and editor.